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Editor of the Month

FRED B. MOOR, M.D.

Los Angeles

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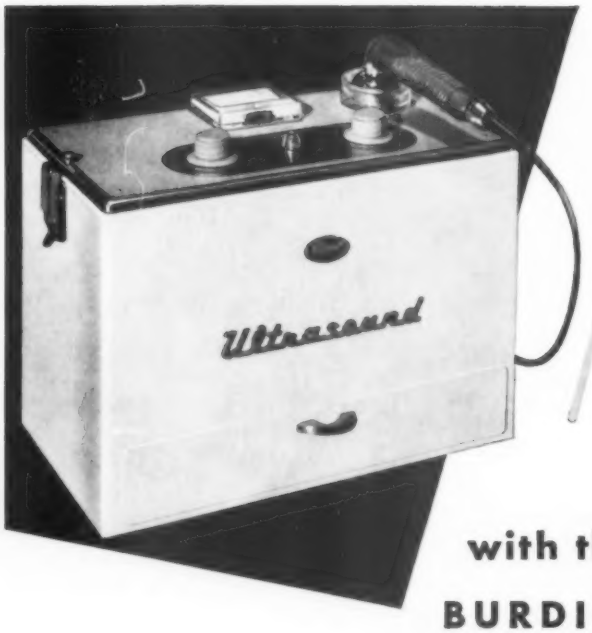

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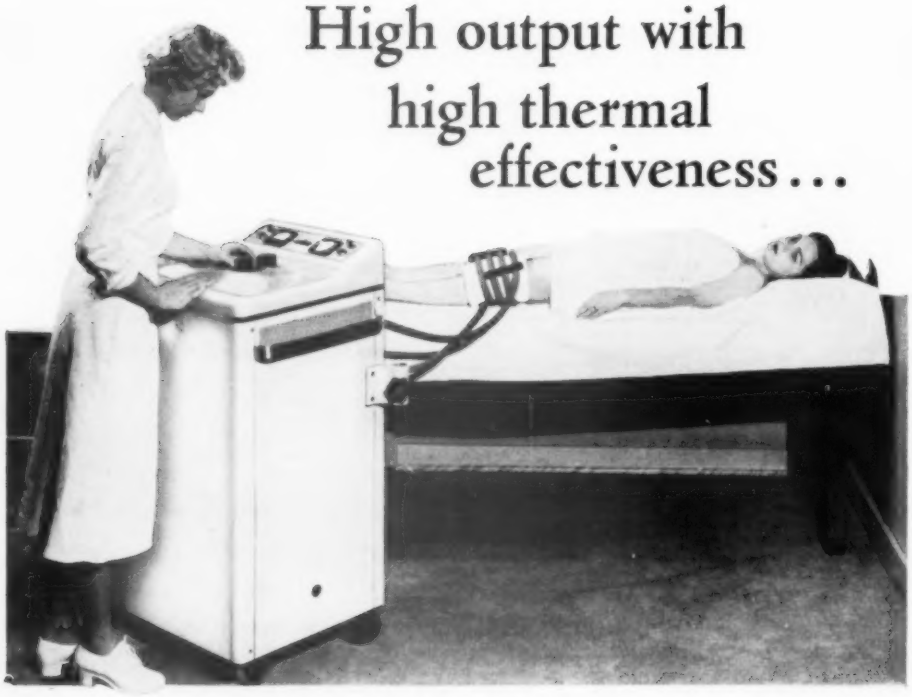

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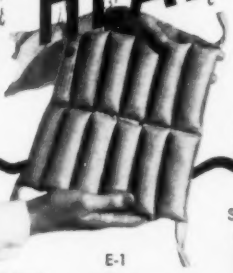

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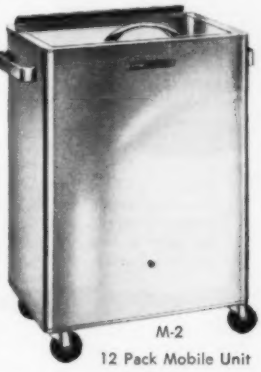

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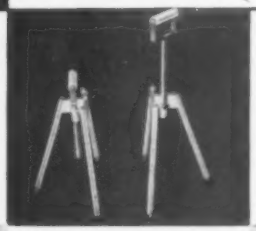

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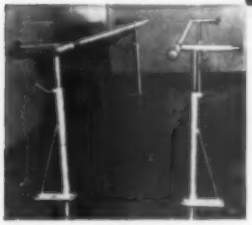

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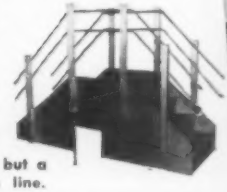

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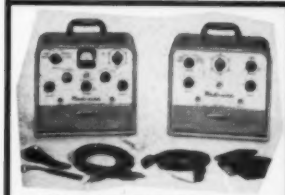

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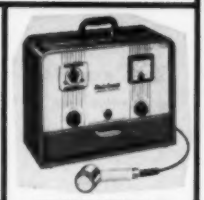

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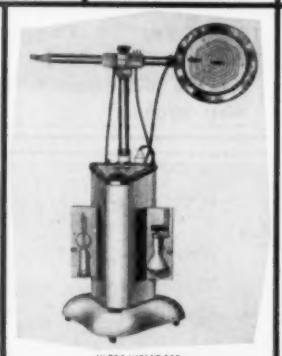

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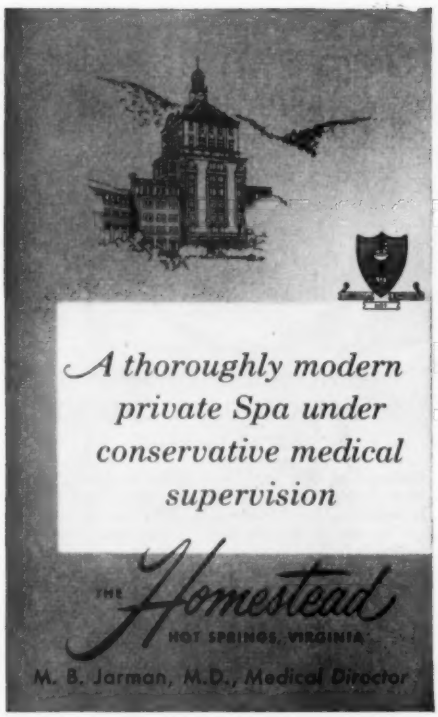

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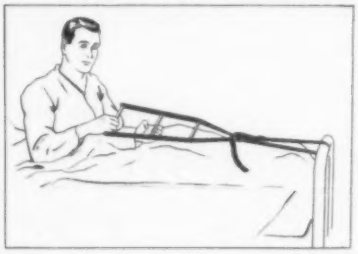

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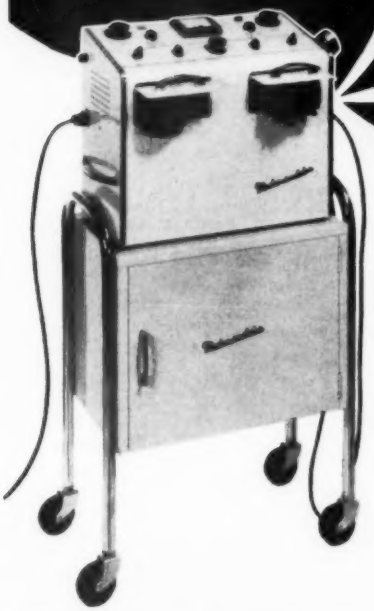

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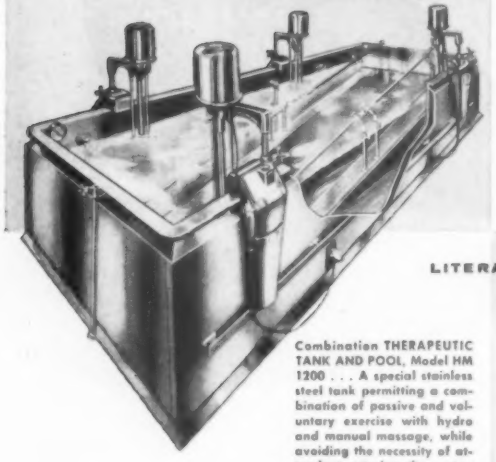

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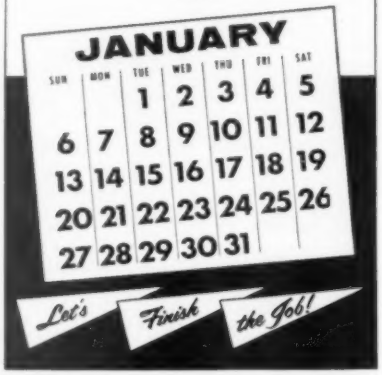

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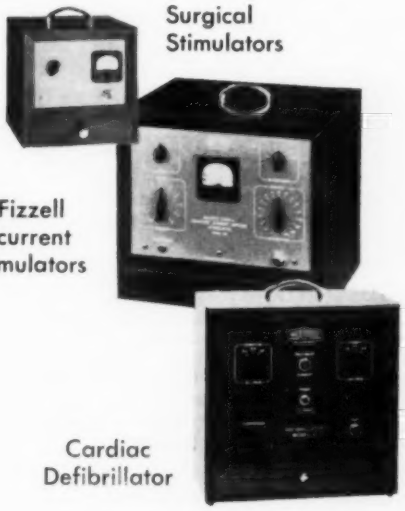

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Vocational Rehabilitation of Patients With Rheumatic Diseases

Martin Acker
San Francisco

The first concentrated rehabilitation service for patients with rheumatic disease who have vocational problems was started in 1953 by the State of New York Chapter, Arthritis and Rheumatism Foundation with the cooperation of the Institute for the Crippled and Disabled. Called the Back to Work project, its goal is to help men and women, disabled as a consequence of their disease, to return to competitive employment, at work for which their illness is not a handicap. An equally important goal of the project is to learn more about the kind and extent of the employment problems faced by arthritis patients and to discover and develop ways in which these problems can be dealt with effectively.

The project's starting point was a study that revealed that many arthritis patients face major problems in obtaining and maintaining employment. Of those who were normally wage earners, over half were found to have been unemployed for more than half the duration of their illness. The study noted that little concerted effort was being made to help such patients solve the problem of being self-supporting while living successfully within the limits of their rheumatic disability.[1] The present paper reports on the results achieved by the Back to Work project from September, 1953 through February, 1956.

Method of Operation

A vocational counselor from the Institute for the Crippled and Disabled directs the project, working on the Institute's premises and utilizing for the clients all of that agency's services.[2] A job placement specialist was added to the project in the fall of 1955.

Clients are referred to the Back to Work project by arthritis clinics, private physicians, and social and other agencies; an increasing proportion are self-referred. Agencies and physicians are asked to refer patients who present vocational problems and who are willing to receive help in this area; they are requested to furnish medical and social work reports with each referral. There are no other criteria for referrals.

The project's clients are not a cross section of the arthritis clinic population nor of the general arthritis population. Obviously, large groups are inadequately represented, such as those employed on jobs suitable to their handicaps, those not normally employed, the house-bound or bedridden, and those for whom a return to work is patently not feasible because of age or substantial emotional problems.

Services Rendered

The first stage in the project's services consists of an assessment of the client's work history, handicaps, interests, motivation, and general living experience. This joint effort by the client and the project director uses materials derived from the first interviews, reports furnished by the referring agencies, and material provided by the Institute's professional services. Counselor and client thus jointly decide on the client's vocational objective and work out the best method of reaching it.

To enable the client to reach his goal, one or more of the following services may be used: a full rehabilitation program including training for a new trade;[2] vocational counselling;[3] or job placement assistance.

Rehabilitation training provided by the Institute includes courses in jewelry mechanics, optical mechanics, leather goods manufacture, welding, office skills, elevator operating, sewing machine operating, and offset printing. When the training needed for a client is not available at the Institute, he is referred to

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some other institution, usually the New York State Division of Vocational Rehabilitation. Prior to entering any Institute training course, the client receives a medical review and, if necessary, psychological, psychiatric, or social work screening. Should treatment in any of these areas be indicated, it is coordinated with the referring agency.

Vocational counselling may include aptitude and interest testing, employing the technic of job task testing in the Institute's guidance test class.[3]

Job placement assistance includes direct job finding efforts, help in developing the client's own job seeking plans, and coordination of his efforts with such community agencies as the New York State Employment Service and J.O.B. (Just One Break, Inc.). When necessary, the client is accompanied to employment interviews and even assisted in the interview. Both project director and placement specialist are active in developing interest and acceptance among potential employers.

The time spent by clients in the program varies, depending upon the individual's motivation, the extent and nature of his disability, his former occupation, and his employment goal. On the average, clients are carried by the project for 6 to 8 months.

Vocationally Pertinent Characteristics of Clients

Table 1 outlines some of the major facts that are important in assessing a client's potential for vocational readjustment.

Men and women were referred in almost equal numbers. In age, the clients ranged from 17 to the 70's; 56 per cent were in the 40-59 age group. About 79 per cent of the clients were normally wage earners. Almost 70 per cent were unemployed when they came to the program, the remainder being either not normally employed or, in most instances, employed on jobs not suited to their rheumatic disability. Those unemployed at referral had been out of work for an average of a little over 3 years.

The impact of rheumatic disease upon these clients and upon their ability to return to gainful employment was difficult to define statistically; however, table 2 indicates the clients' diagnoses and the duration of their illness at the time of referral. The degree of disability ranged from imperceptible or moderate activity impairment to severe residual damage. In a few cases impairment was such as to prevent the use of public transportation.

Table 1: Pertinent Data on Patients in the Back to Work Project

Number of Patients	
Male	105
Female	107
Age at Time of Referral	
Under 20 years	12
20 to 29	22
30 to 39	30
40 to 49	51
50 to 59	68
60 and over	29
Major Occupation at Time of Referral	
Professional, semiprofessional, and managerial	32
Clerical	19
Sales	7
Service	36
Skilled	18
Semiskilled	32
Unskilled	22
Agriculture	1
Not normally employed	45*
Employment Status at Time of Referral	
Employed	20
Unemployed	
Under 1 year	45
1 to 2 years	42
3 to 4 years	19
5 to 9 years	33
10 years or more	9
Not normally employed	44*

* One person with no regular occupation was temporarily employed when referred to the project.

Table 2: Diagnoses and Duration of Illness

Diagnosis		
Osteoarthritis	29	14%
Rheumatoid arthritis	122	58%
Spondylitis	21	10%
Other	26	12%
Unknown	14	6%
Duration of Illness at Time of Referral		
1 through 4 years	55	25%
5 through 9 years	52	24%
10 through 19 years	61	28%
20 years and over	28	16%
Unknown	16	7%

The diagnoses are those given by the referring agency. In 58 per cent of the clients the diagnosis was rheumatoid arthritis. This category also includes clients under 20 years of age who were described by the referring source as having juvenile rheumatoid arthritis or Still's Disease. The category "other" includes gouty arthritis, traumatic arthritis, rheumatoid iritis, arthropathy due to various causes, and one case of hemophilic arthritis. Sixteen clients (many of them self-referred) were not under medical treatment. Since original diagnosis is not done at the Institute, they were listed as diagnosis "unknown."

The duration of illness at the time of referral varied from 1 year to over 20 years, the average period of illness being about 10 years.

Disposition of Clients

Of the 212 persons referred to the project, 85 per cent were accepted on the basis of initial interviews and the materials submitted by referring sources. With self-referred clients, the acceptance was based on initial interviews alone. For each patient accepted vocational prognosis was initially favorable, though the extent of this favorable picture varied considerably.

Table 3: Disposition of 212 Referrals

Returned to work	62
Constructive referrals to other agencies	14
Accepted for program, but withdrew or were closed prior to completion of program	52
Not accepted	31
Cases closed, as of Feb. 29, 1956	159
Cases active, Mar. 1, 1956	53
Total referrals	212

As of March 1, 1956, 159 cases (75 per cent of the referrals) had been closed (table 3). The results obtained for these 159 clients are shown in table 4.

Of the 159 closed cases, 81 per cent were accepted for the Back to Work project; 48 per cent of these returned to work. While some withdrew before completing their rehabilitation programs and returned to previous, unsuitable employment, either because of financial necessity or emotional inability to carry through with rehabilitation, the majority found new jobs that were physically suitable and in which they could utilize skills and interests on a par with nonimpaired workers. For 31, their new jobs represented a change in major occupational category; the other 31 went to work in the same general occupational area as before their illness, but usually on different work. Two thirds of these 62 clients went to work in two major occupations: 22 in the clerical field and 19 in semiskilled industrial work. Starting wages varied from $40 to $125 a week (except for the three clients employed in sheltered workshops). Two clients in their 50's (one of whom had never worked regularly and the other having been bedridden with rheumatoid arthritis for years) and one in his 40's earned substantial wage increases within the first year of work.

The 14 clients who received constructive referrals to other agencies include five patients with juvenile rheumatoid arthritis who are receiving long-term training under the auspices of the State Division of Vocational Rehabilitation and nine who were referred to agencies which, for geographic or other reasons,

Table 4: Results in 159 Cases Closed From Sept. 1953 Through Feb. 1956

Cases Accepted		
Returned to work		
Completed program		
Competitive industry	45	
Sheltered workshop	3	
Withdrew from program	14	
		62
Constructive referrals to other agencies		14
Did not return to work		
Withdrew from program	24	
Dropped from program		
For physical reasons	11	
For emotional reasons	17	
		52
		128
Cases Not Accepted		
For physical reasons		8
For emotional reasons		3
Because of age		3
Services not needed		17
		31

can serve them more appropriately than can the Back to Work project.

Discussion

The Back to Work project was based on the proposition that selected patients whose rheumatic disorders prevented them from earning their living could be returned to work in competition with healthy workers and without harm to themselves and that they could maintain such readjustments over periods of time comparable to the duration of employment of normal people. This proposition in turn assumed that neither the erratic course of the disease, its pain, its physical impairment, nor the emotional problems sometimes associated with it, necessarily preclude vocational rehabilitation.[4]

The experience so far suggests that the premises are reasonable; 39 per cent of those referred and 48 per cent of those accepted succeeded in returning to self-support. Although a few of those referred were not accepted because of physical disability, such cases were a small minority.

While many clients presented emotional problems,[5] a relatively small group were excluded at the outset or dropped after their programs started for that reason. Once involved in a constructive effort, most clients with emotional difficulties seemed able to progress satisfactorily, usually without specific treatment or assistance for these problems. In particular, it was noted that clients suffering from rheumatoid arthritis returned to work at the same rate as the group as a whole. The widely held concern over the negative impact of emotional problems on the rehabilitation of people with rheumatic diseases does not, therefore, seem substantiated by the experience of the Back to Work project.

The client's motivation is, of course, an essential factor in his rehabilitation. Identifying and strengthening this quality is a vitally important function of the project and of the vocational counselor. In general, referral to the project was not "prescribed" by the clinic or private physician. The fact that potential clients, rather than a clinic or physician, usually made the first appointment, doubtless helped select clients with at least minimal motivation; however, after introduction to the often long and tedious processes of rehabilitation, this motivation was frequently severely taxed. To sustain and strengthen the drive that first brought them across the threshhold, most clients needed substantial assistance. This was rendered through intensive personal counselling and, in part, by exposure to possibilities for resuming a more normal existence. Possibilities of success demonstrated by clients already involved often served to stimulate hesitant clients to expend the physical and emotional energy necessary for their own rehabilitation.

The degree of mechanical impairment of the clients varied widely. Successful placements were made for clients with such extreme disabilities as a fused spine and hips. Within certain obvious limits, the extent of the impairment was not a determining factor in the success of rehabilitation.[6] In some cases specific aids were obtained or designed, such as orthopedic shoes, typing aids, and specially designed chairs.[7] Such aids were related to the kind of job for which the client was preparing and were of types acceptable in normal employment situations. For some clients unable to use public transportation, jobs were found in locations sufficiently near their homes to permit them to use taxis in going to and from work. One or two received sufficient benefit from physical therapy treatments to permit them to resume the use of public transportation. Thus, even extensive physical impairment does not seem to preclude a return to self-support in a competitive labor market.

The arthritic patient's ability to maintain employment, once achieved through rehabilitation, will be the ultimate test of the Back to Work project. For chronically ill people with an average of 3 years of unemployment, employment lasting even for several months is not yet proof of the enduring effect of rehabilitation. The project attempts to maintain contact with all former clients. In January, 1956 a questionnaire sent to the 54 persons who had by then returned to work was answered by 39. Sixty per cent were still at work; 13 per cent had had to leave work for health reasons.

A large majority of those still at work are employed on the job obtained at the termination of their rehabilitation program. Several were placed as early as 2 years ago and are still employed. A large proportion have been upgraded in salary or responsibility; however, experience with more clients and over a longer period is necessary before definitive conclusions can be drawn.

The Back to Work program is conducted in a multi-discipline rehabilitation center oriented to the team approach.[8] Although the high proportion of successful cases may be attributed to many factors, a major factor is the close integration of workers of varied professions in a team of which the client himself is a vital, integral part.

Summary

A project was undertaken for the rehabilitation of rheumatic patients with vocational problems. Of 159 cases closed in 30 months, 62 returned to work, 14 were referred to other agencies, 52 did not complete the rehabilitation program, and 31 were rejected as unsuitable to the project.

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Clinical Application of Electromyography

Bernard J. Doyle, M.D.
Boston

Although electromyographic recordings have been made for almost 50 years and the coaxial needle has been used for over 25 years, electromyography is not in as general use today as was expected. A great variety of papers have been written on this subject, but a complete bibliography is beyond the scope of this paper. The references in this paper represent for the most part those publications that I have found most helpful as reference material in learning and doing electromyography. Only one monograph has been written thus far.[1] To the average clinician, however, the plethora of data presented, the difficulties encountered in testing, and the apparent variations in interpretation of findings have resulted in considerable confusion. Because of these reasons, expensive electromyographic instruments procured originally with high expectations now lie idle or are at best seldom used. It is hoped that this paper will lessen the confusion concerning electromyographic examinations and the findings in certain pathological conditions. As a result physiatrists can avail themselves of this added means of gaining more knowledge of neuromuscular diseases in general and in individual patients. Although much of the material in this paper is not original, it is hoped that the simplified outlines may evoke greater interest in the application of electromyographic examinations. There is no doubt that considerable time and study must be used by the electromyographer in order to know what he is looking for, how to find it, and how to interpret his findings. This cannot be stressed too much. Electromyography does not become a simple and easy test with definite positive findings except after sustained use. At present, the use of electromyography is in direct proportion to the enthusiasm of the electromyographer in a particular institution.

Available Electromyographic Equipment

Most of the studies of the past few years are based on electromyograms made with a cathode ray oscilloscope and needle electrodes. Marinacci obtains all of his electromyograms using this technic;[1] however, the inkwriter technic, in which a multiple channel encephalograph, is used with either surface or needle electrodes, is still valuable in many instances, when knowledge of the electrical activity of muscles is desired. Watkins[2] has outlined the findings in certain conditions using the inkwriter technic. Huddleston and co-workers[3] mention that a multiple channel electromyograph may be desirable for certain clinical investigations and basic neuromuscular research, and may also be used successfully in evaluating spasticity, rigidity, sensitivity to stretch reflexes, and electrical behavior of antagonistic and synergistic muscles during voluntary and coordinated reflex activity seen in upper motor neuron and extrapyramidal disabilities.

In the conditions involving lower motor neuron lesions, surface electrodes and the use of the electroencephalographic apparatus is not sufficient. In these conditions electromyographic examinations should always be made on a cathode ray oscilloscope with needle electrodes. A number of machines adequate for this technic are now commercially available. Two of these machines have a dual beam oscilloscope allowing records to be made simultaneously from two muscles or two parts of the same muscle. Both have attachments for recording the oscilloscope tracing and sound on magnetic tape; one may be played back at a reduced speed and re-recorded on an inkwriter recorder. By this method fibrillation voltages may be made on a permanent record immediately. Another commercially available machine records by means of a kymograph camera both on

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From the Physical Medicine Rehabilitation Service, VA Hospital.

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film and paper with a loudspeaker monitor.

Electromyographic Findings

Under physiological conditions, during complete muscular relaxation and in the absence of neuromuscular disease there is electrical silence evidenced by a smooth base line (fig. 1*A*). During a minimal volition simple motor unit voltages having between one and six phases, an amplitude of 100 to 3000 μv (microvolts), a duration of 5 to 10 milliseconds, and a frequency of 5 to 30 per second, depending on the effort, are recorded (fig. 1*B*). On the loudspeaker, simple motor unit discharges present the sound of a sharp thumping. Maximal volition (fig. 1*C*) produces interfering pattern[4, 5] electrical activity with a sustained mean voltage over 100 μv, as read on the integrating meter (table 1).

With denervation two distinct patterns of electrical activity occur: fibrillation voltages (fig. 2*A*) and positive sharp wave voltages (fig. 2*B*). Fibrillation voltages are the result of involuntary contractions of individual muscle fibers.[6, 7] They are monophasic or diphasic, have amplitudes of 10 to 100 μv, a duration of 1 to 2 milliseconds, and a frequency of 2 to 30 per second. They occur irregu-

Table 1: Normal Electromyographic Findings

At rest	Electrical silence
On minimal volition	Simple motor unit voltages
Polyphasic	1 to 6 phases
Voltage	100 to 3000 μv
Duration	5 to 10 milliseconds
Frequency	5 to 30 per second
Sound	Sharp thumping
On maximal volition	Sustained interfering pattern electrical activity of over 100 μv on the integrating meter

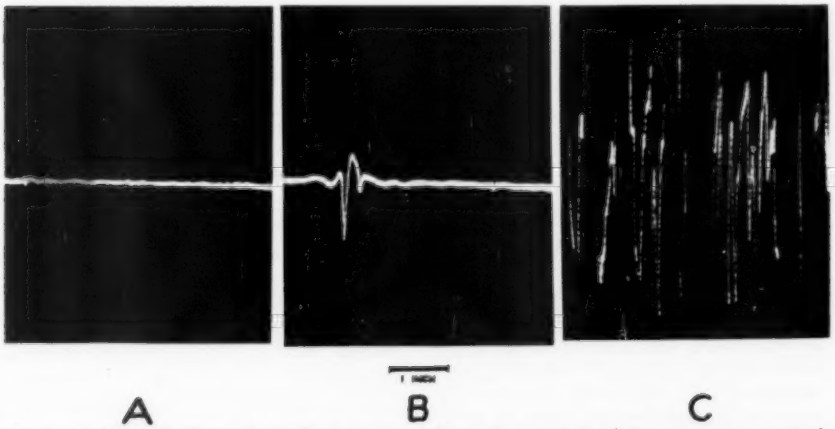

Fig. 1 — *A*, Electrical silence; *B*, simple motor unit voltage; *C*, normal interfering pattern on maximal volition. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

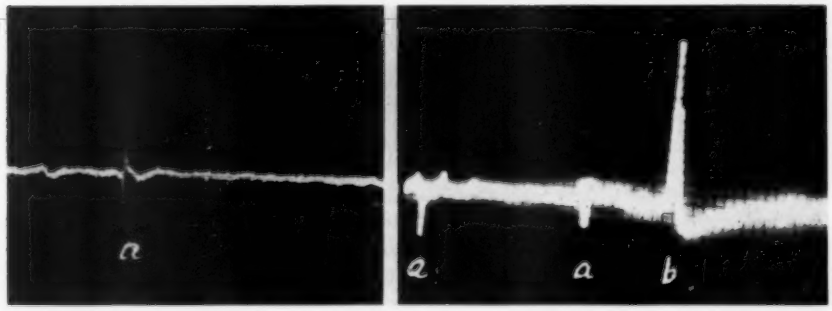

Fig. 2 — *a*, Fibrillation voltage; *b*, positive sharp wave voltage. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

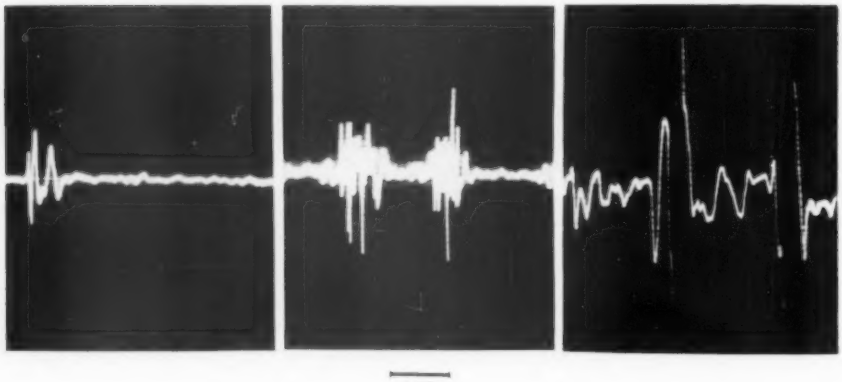

Fig. 3 — A, Fasciculation voltage; B, complex motor unit voltage; C, "Giant" polyphasic motor unit voltage. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

larly, diminish and often stop abruptly. On the audio monitor the sound is like fine rain falling on a tin roof. Individual fibrillations have the sound of sharp clicks (table 2). These fibrillations are classified as active or inactive. Inactive fibrillations usually become active by stimulation of the exploring needle electrode.

The positive sharp wave voltages[1] (table 3) are followed by a prolonged negative phase with a total duration up to 100 milliseconds. These voltages are produced during insertion and exploration and have amplitudes up to 2000μv. The sound is like that of distant thunder; the frequency is the same as for fibrillation. At times these voltages may be of such frequency and sound character that they are confused with high frequency discharges seen in myotonia.

Another abnormal electromyographic finding is a fasciculation voltage (table 4). These voltages have been described and classified by Denny-Brown[8] and by Richardson.[9] They are the electromyographic representation of involuntary contractions of single motor units. They occur during rest and are polyphasic, having amplitudes of 100 to 2000 μv, and a duration of 5 to 15 milliseconds (fig. 3*A*). They have irregular frequencies-1 to 50 per minute. On the loudspeaker they have a low-pitched hollow sound. They occur in progressive lesions of the anterior horn cells, in compression le-

Table 2: Fibrillation Voltages

Monophasic or diphasic	
Voltage	10 to 100 μv
Duration	1 to 2 milliseconds
Frequency	2 to 30 per second
	Irregular, diminishing, and often stopping abruptly
	May be mechanically induced or spontaneous (active or inactive)
Sound	Sharp clicking

Table 3: Positive Sharp Wave Voltages

Followed by a prolonged negative phase	
Produced during insertion and exploration	
Voltage	Up to 200 μv
Duration	Up to 100 milliseconds
Frequency	Same as for fibrillations
Sound	Like distant thunder
Not to be confused with high frequency discharges seen in myotonia	

Table 4: Fasciculation Voltages

Occurrence	During rest, spontaneous
Polyphasic	Up to 20 phases
Voltage	100 to 2000 μv
Duration	5 to 15 milliseconds
Frequency	Irregularly, 1 to 50 per minute
Sound	Low-pitched, hollow
Seen in progressive lesions of the anterior horn cells, in compression lesions, and with muscle cramps	

Table 5: Complex Motor Unit Voltages

Occurrence	On minimal voluntary effort
Polyphasic	Up to 25 phases
Voltage	25 to 5000 μv (av.: 100 to 1000 μv)
Duration	2 to 30 milliseconds
Frequency	2 to 20 per second
Sound	Disintegrated, rough, crackling
Separate type: "Giant" polyphasic motor unit voltage	
3 to 6 phases	
Voltage	Up to 12 μv
Duration	20 to 30 milliseconds

Table 6: Occurrence of Denervated Activity Fibrillation and Sharp Wave Voltages Seen in All Cases of Lower Motor Neuron Involvement

Anterior horn cell disease
Poliomyelitis — 21 days after onset
Progressive spinal muscular atrophy
Amyotrophic lateral sclerosis
Nerve root and segmental spinal cord lesions
Tumor
Compression
Herniated disc
Radiculitis, neuronitis
Plexitis, neuritis
Peripheral nerve injury — after 15 days

Table 7: Differential Electromyographic Diagnosis

Poliomyelitis: Spotty, plurisegmental. May extend far beyond clinically affected muscle groups.	
Nerve root lesion: Restricted to radicular distribution but present in both anterior and posterior primary divisions.	
Neuronitis: More prominent in longest axones; not uniformly distributed; more abundant distally in affected limb(s).	
Plexitis	Follows anatomic distribution
Peripheral neuritis	Follows anatomic distribution
Traumatic peripheral nerve lesion	Follows anatomic distribution
From site of lesion distally.	

Table 8: Electromyographic Findings in Progressive Spinal Muscular Atrophy and Amyotrophic Lateral Sclerosis

Plurisegmental denervated activity in both anterior and posterior primary divisions.
More Uniform than in poliomyelitis.
Present in other extremities whether clinically affected or not.
Fasciculations may be observed clinically and electromyographically with denervated activity on clinically suspected and unsuspected muscles.

sions, and with muscle cramps.

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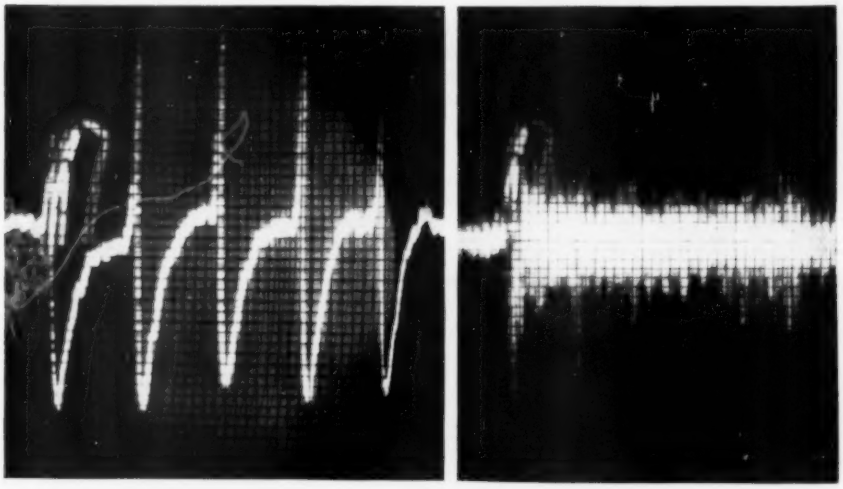

Fig. 4 — Electromyographic picture of myotonia in the convalescent stage in a patient with familial periodic paralysis. (Amplitude calibrated 100 μv to the inch; A, 1 inch = 30 milliseconds; B, 1 inch = 1 second).

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Summary

The types of clinical instruments available for electromyographic examinations are discussed briefly. Normal and abnormal electromyographic findings are presented in an outline form. Basic wave forms are included. It is hoped that the differential diagnosis of lower motor neuron disease will be simplified to some extent by emphasis on observing the localization and distribution of the denervated activity. In the diagnosis of a root lesion the survey muscles presented in diagram form will also simplify electromyographic testing. Some practical clinical considerations also are presented.

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A large majority of those still at work are employed on the job obtained at the termination of their rehabilitation program. Several were placed as early as 2 years ago and are still employed. A large proportion have been upgraded in salary or responsibility; however, experience with more clients and over a longer period is necessary before definitive conclusions can be drawn.

The Back to Work program is conducted in a multi-discipline rehabilitation center oriented to the team approach.[8] Although the high proportion of successful cases may be attributed to many factors, a major factor is the close integration of workers of varied professions in a team of which the client himself is a vital, integral part.

Summary

A project was undertaken for the rehabilitation of rheumatic patients with vocational problems. Of 159 cases closed in 30 months, 62 returned to work, 14 were referred to other agencies, 52 did not complete the rehabilitation program, and 31 were rejected as unsuitable to the project.

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Clinical Application of Electromyography

Bernard J. Doyle, M.D.
Boston

Although electromyographic recordings have been made for almost 50 years and the coaxial needle has been used for over 25 years, electromyography is not in as general use today as was expected. A great variety of papers have been written on this subject, but a complete bibliography is beyond the scope of this paper. The references in this paper represent for the most part those publications that I have found most helpful as reference material in learning and doing electromyography. Only one monograph has been written thus far.[1] To the average clinician, however, the plethora of data presented, the difficulties encountered in testing, and the apparent variations in interpretation of findings have resulted in considerable confusion. Because of these reasons, expensive electromyographic instruments procured originally with high expectations now lie idle or are at best seldom used. It is hoped that this paper will lessen the confusion concerning electromyographic examinations and the findings in certain pathological conditions. As a result physiatrists can avail themselves of this added means of gaining more knowledge of neuromuscular diseases in general and in individual patients. Although much of the material in this paper is not original, it is hoped that the simplified outlines may evoke greater interest in the application of electromyographic examinations. There is no doubt that considerable time and study must be used by the electromyographer in order to know what he is looking for, how to find it, and how to interpret his findings. This cannot be stressed too much. Electromyography does not become a simple and easy test with definite positive findings except after sustained use. At present, the use of electromyography is in direct proportion to the enthusiasm of the electromyographer in a particular institution.

Available Electromyographic Equipment

Most of the studies of the past few years are based on electromyograms made with a cathode ray oscilloscope and needle electrodes. Marinacci obtains all of his electromyograms using this technic;[1] however, the inkwriter technic, in which a multiple channel encephalograph, is used with either surface or needle electrodes, is still valuable in many instances, when knowledge of the electrical activity of muscles is desired. Watkins[2] has outlined the findings in certain conditions using the inkwriter technic. Huddleston and co-workers[3] mention that a multiple channel electromyograph may be desirable for certain clinical investigations and basic neuromuscular research, and may also be used successfully in evaluating spasticity, rigidity, sensitivity to stretch reflexes, and electrical behavior of antagonistic and synergistic muscles during voluntary and coordinated reflex activity seen in upper motor neuron and extrapyramidal disabilities.

In the conditions involving lower motor neuron lesions, surface electrodes and the use of the electroencephalographic apparatus is not sufficient. In these conditions electromyographic examinations should always be made on a cathode ray oscilloscope with needle electrodes. A number of machines adequate for this technic are now commercially available. Two of these machines have a dual beam oscilloscope allowing records to be made simultaneously from two muscles or two parts of the same muscle. Both have attachments for recording the oscilloscope tracing and sound on magnetic tape; one may be played back at a reduced speed and re-recorded on an inkwriter recorder. By this method fibrillation voltages may be made on a permanent record immediately. Another commercially available machine records by means of a kymograph camera both on

Read at the Thirty-third Annual Session of the American Congress of Physical Medicine and Rehabilitation, Detroit, August 31, 1955.

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film and paper with a loudspeaker monitor.

Electromyographic Findings

Under physiological conditions, during complete muscular relaxation and in the absence of neuromuscular disease there is electrical silence evidenced by a smooth base line (fig. 1*A*). During a minimal volition simple motor unit voltages having between one and six phases, an amplitude of 100 to 3000 μv (microvolts), a duration of 5 to 10 milliseconds, and a frequency of 5 to 30 per second, depending on the effort, are recorded (fig. 1*B*). On the loudspeaker, simple motor unit discharges present the sound of a sharp thumping. Maximal volition (fig. 1*C*) produces interfering pattern[4, 5] electrical activity with a sustained mean voltage over 100 μv, as read on the integrating meter (table 1).

With denervation two distinct patterns of electrical activity occur: fibrillation voltages (fig. 2*A*) and positive sharp wave voltages (fig. 2*B*). Fibrillation voltages are the result of involuntary contractions of individual muscle fibers.[6, 7] They are monophasic or diphasic, have amplitudes of 10 to 100 μv, a duration of 1 to 2 milliseconds, and a frequency of 2 to 30 per second. They occur irregu-

Table 1: Normal Electromyographic Findings

At rest	Electrical silence
On minimal volition	Simple motor unit voltages
Polyphasic	1 to 6 phases
Voltage	100 to 3000 μv
Duration	5 to 10 milliseconds
Frequency	5 to 30 per second
Sound	Sharp thumping
On maximal volition	Sustained interfering pattern electrical activity of over 100 μv on the integrating meter

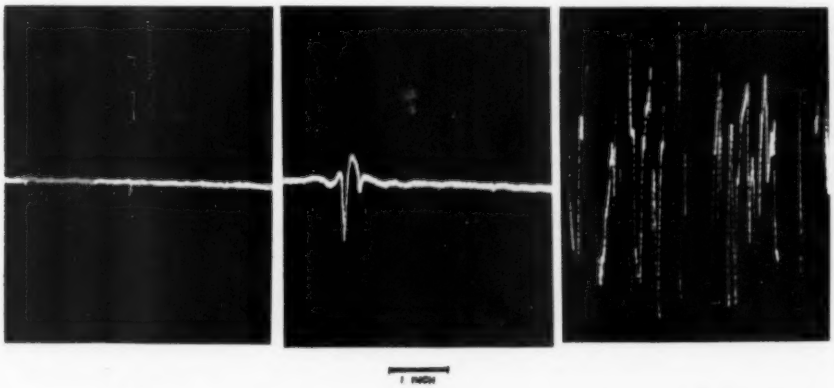

Fig. 1 — A, Electrical silence; B, simple motor unit voltage; C, normal interfering pattern on maximal volition. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

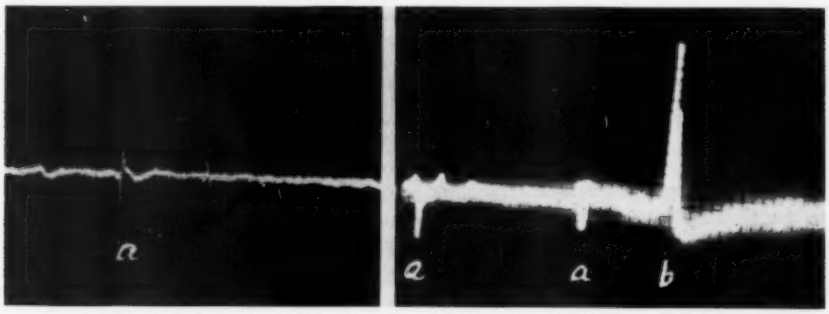

Fig. 2 — a, Fibrillation voltage; b, positive sharp wave voltage. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

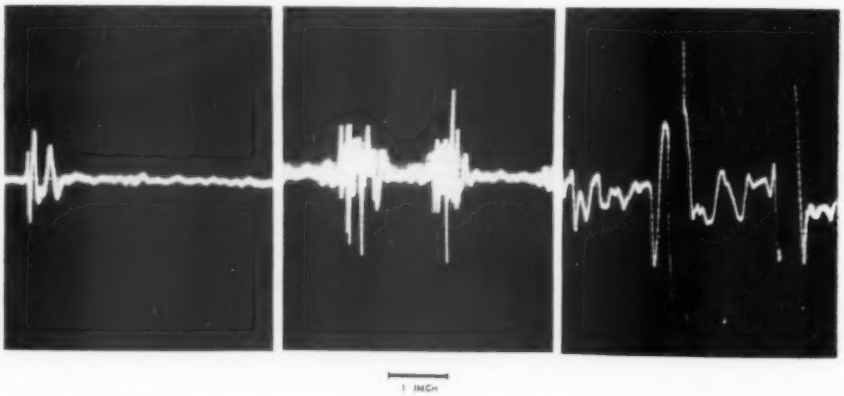

Fig. 3 — A, Fasciculation voltage; B, complex motor unit voltage; C, "Giant" polyphasic motor unit voltage. (Amplitude calibrated 200 μv to the inch; duration calibrated 30 milliseconds to the inch).

larly, diminish and often stop abruptly. On the audio monitor the sound is like fine rain falling on a tin roof. Individual fibrillations have the sound of sharp clicks (table 2). These fibrillations are classified as active or inactive. Inactive fibrillations usually become active by stimulation of the exploring needle electrode.

The positive sharp wave voltages[1] (table 3) are followed by a prolonged negative phase with a total duration up to 100 milliseconds. These voltages are produced during insertion and exploration and have amplitudes up to 2000μv. The sound is like that of distant thunder; the frequency is the same as for fibrillation. At times these voltages may be of such frequency and sound character that they are confused with high frequency discharges seen in myotonia.

Another abnormal electromyographic finding is a fasciculation voltage (table 4). These voltages have been described and classified by Denny-Brown[8] and by Richardson.[9] They are the electromyographic representation of involuntary contractions of single motor units. They occur during rest and are polyphasic, having amplitudes of 100 to 2000 μv, and a duration of 5 to 15 milliseconds (fig. 3*A*). They have irregular frequencies-1 to 50 per minute. On the loudspeaker they have a low-pitched hollow sound. They occur in progressive lesions of the anterior horn cells, in compression le-

Table 2: Fibrillation Voltages

Monophasic or diphasic	
Voltage	10 to 100 μv
Duration	1 to 2 milliseconds
Frequency	2 to 30 per second
	Irregular, diminishing, and often stopping abruptly
	May be mechanically induced or spontaneous (active or inactive)
Sound	Sharp clicking

Table 3: Positive Sharp Wave Voltages

Followed by a prolonged negative phase	
Produced during insertion and exploration	
Voltage	Up to 200 μv
Duration	Up to 100 milliseconds
Frequency	Same as for fibrillations
Sound	Like distant thunder
Not to be confused with high frequency discharges seen in myotonia	

Table 4: Fasciculation Voltages

Occurrence	During rest, spontaneous
Polyphasic	Up to 20 phases
Voltage	100 to 2000 μv
Duration	5 to 15 milliseconds
Frequency	Irregularly, 1 to 50 per minute
Sound	Low-pitched, hollow
Seen in progressive lesions of the anterior horn cells, in compression lesions, and with muscle cramps	

Table 5: Complex Motor Unit Voltages

Occurrence	On minimal voluntary effort
Polyphasic	Up to 25 phases
Voltage	25 to 5000 μv (av.: 100 to 1000 μv)
Duration	2 to 30 milliseconds
Frequency	2 to 20 per second
Sound	Disintegrated, rough, crackling
Separate type: "Giant" polyphasic motor unit voltage	
3 to 6 phases	
Voltage	Up to 12 μv
Duration	20 to 30 milliseconds

Table 6: Occurrence of Denervated Activity Fibrillation and Sharp Wave Voltages Seen in All Cases of Lower Motor Neuron Involvement

Anterior horn cell disease
Poliomyelitis — 21 days after onset
Progressive spinal muscular atrophy
Amyotrophic lateral sclerosis
Nerve root and segmental spinal cord lesions
Tumor
Compression
Herniated disc
Radiculitis, neuronitis
Plexitis, neuritis
Peripheral nerve injury — after 15 days

Table 7: Differential Electromyographic Diagnosis

Poliomyelitis: Spotty, plurisegmental. May extend far beyond clinically affected muscle groups.	
Nerve root lesion: Restricted to radicular distribution but present in both anterior and posterior primary divisions.	
Neuronitis: More prominent in longest axones; not uniformly distributed; more abundant distally in affected limb(s).	
Plexitis	Follows anatomic distribution
Peripheral neuritis	Follows anatomic distribution
Traumatic peripheral nerve lesion	Follows anatomic distribution
From site of lesion distally.	

Table 8: Electromyographic Findings in Progressive Spinal Muscular Atrophy and Amyotrophic Lateral Sclerosis

Plurisegmental denervated activity in both anterior and posterior primary divisions.
More Uniform than in poliomyelitis.
Present in other extremities whether clinically affected or not.
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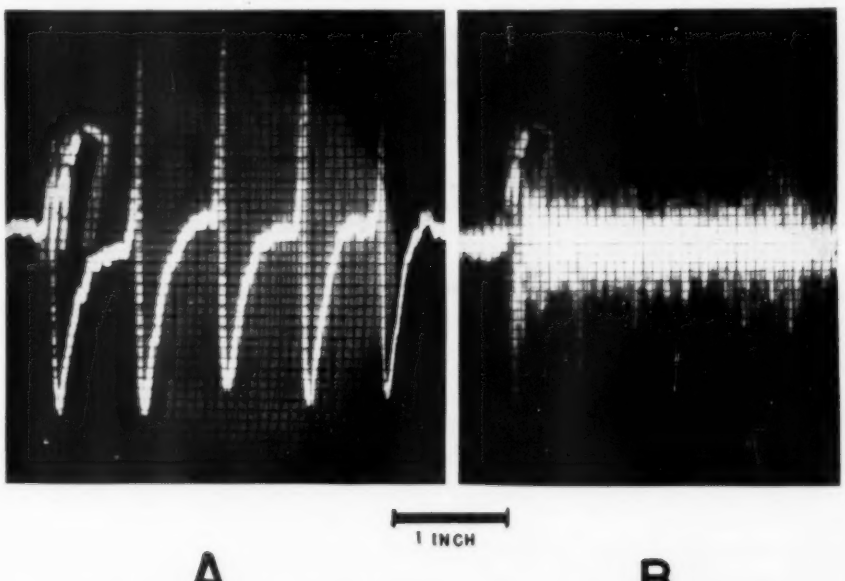

Fig. 4 — Electromyographic picture of myotonia in the convalescent stage in a patient with familial periodic paralysis. (Amplitude calibrated 100 μv to the inch; A, 1 inch = 30 milliseconds; B, 1 inch = 1 second).

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At the VA Hospital in Boston, reports to the referring physicians are in a narrative form with subheadings of *technic* (whether cathode ray oscilloscope or ink-writer, and type of electrodes, whether surface, unipolar needle, or concentric needle), *muscles examined, results* (under which the electromyographic findings are recorded), and *impressions*. In other institutions, the mode of reporting the electromyographic findings varies, but the objective is to be of the most possible help to the referring physician.

Summary

The types of clinical instruments available for electromyographic examinations are discussed briefly. Normal and abnormal electromyographic findings are presented in an outline form. Basic wave forms are included. It is hoped that the differential diagnosis of lower motor neuron disease will be simplified to some extent by emphasis on observing the localization and distribution of the denervated activity. In the diagnosis of a root lesion the survey muscles presented in diagram form will also simplify electromyographic testing. Some practical clinical considerations also are presented.

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Management of the Neurogenic Bladder

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Care of the genitourinary tract is an important aspect in the management of the patient with spinal cord injury. Mortality and morbidity rates in paraplegia are well correlated with the quality of care to the genitourinary system. Statistical studies have revealed that genitourinary dysfunction is the most common cause of death subsequent to the immediate postinjury period. Thus proper urological care should attempt both to prevent and to correct urinary complications.

The care of the genitourinary tract influences and modifies the other therapeutic factors in the management of the paraplegic patient, among which are many psychological and social considerations relative to the control of micturition. Many paraplegic patients become depressed because of the loss of sphincteric control and repeated urinary infections. It thus becomes more difficult to readjust the patient to society and to plan his future vocation.

Prior to World War II, patients with spinal cord injury usually died within a relatively short time, the majority within a year.[1-6] Out of the experience gained since that time the results in the care of paraplegia have been gratifying. The contributions of Munro,[7, 8] Bors,[9-14] Talbot,[15-18] and Guttmann and coworkers[2-4] have been noteworthy. The advent of antibiotics has helped to reduce morbidity and mortality; however, unanimity is still lacking on some aspects in the treatment of the neurogenic bladder.

The purpose of this paper is to present a plan that may serve as a guide for the treatment of urologic problems of spinal cord injury cases.

Mechanism of Micturition

Normal Bladder: A brief review of the physiology of the normal bladder provides a basis for a better understanding of bladder function after spinal cord injury. The essential function of the bladder is the storage and periodic emptying of urine. This is accomplished normally by the activity of a highly organized neurological apparatus involving the autonomic nervous system, the somatic nerves, the spinal cord, and the higher cortical centers.

The distention of the bladder beyond a certain critical level causes afferent inpulses to travel along the pelvic nerves to the spinal cord at S 2, 3 and 4 segments. The efferent impulse goes by way of the pelvic nerve (parasympathetic fibers) to the detrusor muscle, causing it to contract and the internal sphincter to relax. The external sphincter relaxes as the result of urine escaping into the posterior urethra. The stimulus of the urine on the external sphincter is mediated through the pudendal nerve (somatic nerve from S 2, 3 and possibly 4). The sympathetic innervation of the trigone area would appear to have questionable effect on the mechanism of micturition.

This sequence represents the process of micturition in the infant; however, when a child has been trained, cerebral control over the external sphincter causes it to remain closed, except under socially acceptable conditions for voiding. Voiding is prevented when the detrusor muscle is unable to overcome the resistance offered by the external sphincter. This cerebral inhibition of voiding can be maintained for a considerable length of time after the desire to urinate is first experienced.

Neurogenic Bladder: Spinal cord injury results in a disruption of the normal control of bladder function by the higher centers. This disorganization presents a sequence of classic stages or phases of

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bladder function. They are the atonic, the autonomous, the hypertonic (spastic), and the automatic bladder.

Phase 1 — Atonic Bladder. Following spinal cord injury the segment of the cord below the level of the lesion loses all reflex activity for a varying period of time. This is called the spinal shock phase. The bladder at this stage is generally considered to be atonic; there are no detrusor contractions. The internal sphincter is closed and the bladder does not respond to the stimulus of distention. The external sphincter is relaxed. Unless a catheter is introduced, the bladder would fill passively to its anatomic capacity and an overflow incontinence would result. This overstretching of the bladder would result in damage to the detrusor muscle and the intrinsic ganglia.

Phase 2 — Autonomous Bladder. As the bladder regains some of its tone, the second stage is reached, producing the so-called autonomous bladder. This is characterized by ineffective, abortive emptying contractions. The bladder neck is closed except for small, frequent spurts of urine escaping through it.

Phase 3 — Hypertonic Bladder. The hypertonic bladder is characterized by a small capacity and by irregular, frequent and very strong detrusor contractions that may or may not be accompanied by relaxation of the external sphincter. The spasticity of the pelvic floor may prevent the usual reciprocal relaxation of the sphincter when the detrusor contracts. Frequent voidings of small amounts of urine are observed clinically. In cervical and high thoracic lesions severe autonomic manifestations are often associated with urinary retention, such as nonthermoregulatory sweating, pilo-erection, severe headaches, and paroxysmal hypertension.

Phase 4 — Automatic Bladder. The automatic or reflex bladder has a capacity of about 300 cc. It resembles the action of the bladder of infants before training. When the critical capacity is reached, the detrusor contracts reflexly and causes effective emptying of the bladder. The time interval between voidings may be several hours. This is the type of bladder sought in a complete cord lesion above the level of the conus.

Obviously, stages 3 and 4 are not found in conus or cauda equina injuries, because of loss of the sacral reflex center. In these cases the bladder function is controlled by ganglia located between the layers of the detrusor. Progress through the different stages may be interrupted at any point, and regression to any previous stage may take place, due to such conditions as urinary infection, calculi, and decubitus ulcers. In partial transection of the cord, the bladder function will vary depending upon the level of the lesion and degree of damage to the cord.

Urological Studies

In order to evaluate properly the status of the genitourinary tract and to follow its progress, the following tests are indicated and should be repeated as necessary:

1. Urine analysis — Determination of pH and microscopic examination should be included.

2. Blood chemistry — Blood urea nitrogen should be tested routinely. When indicated, a more complete study should be done, which might include the determination of carbon dioxide, calcium, phosphorus, total protein, albumin-globulin ratio, chlorides, sodium, and potassium.

3. Urine culture and antibiotic sensitivity test — These measures may be necessary for patients with urinary infection not responding to routine therapy. Urine must be collected under sterile conditions. Sensitivity tests will aid in the selection of the most effective drug to combat the urinary infection.

4. Intravenous pyelogram — Pyelograms are taken to determine presence or absence of calculi, hydronephrosis, hydroureter, or nonfunctioning kidney.

5. Cystometric examination—A Lewis recording cystometer or a water manometer is used. The objective is to determine the bladder tone and capacity and the amount of residual urine. After every 50 cc. of increment a record is made of the changes in the intracystic pressure, blood pressure, autonomic phenomena, or subjective symptoms. When the fluid stops flowing, the capacity of

the bladder has been reached. The catheter is then removed, the patient allowed to void, and the residual urine determined.

6. Cystogram — This is taken to determine presence or absence of ureteral reflux. It may also show changes in bladder outline, such as diverticula and relaxation of the internal sphincter. Radiopaque dye is introduced into the bladder and x-rays taken immediately and one-half hour later.

7. Residual urine—This is determined on repeated occasions with the patient in varying positions. Good function is associated with less than 20 per cent residual of capacity in neurogenic bladders resulting from upper motor neuron injuries, and less than 10 per cent in those resulting from lower motor neuron injuries. Large residuals predispose to urinary infection and stone formation.

8. Sphincterometry—To determine the tone of the external sphincter, a catheter is inserted into the urethra distal to the external sphincter. It is connected to an irrigating flask and with a Y-tube to a water manometer. The pressure rises in the manometer; the point at which the pressure suddenly drops determines the sphincteric resistance.

9. Cystoscopy — This procedure is indicated when persistent alkalinity of the urine, hematuria, chronic urinary infection, and/or autonomic manifestations suggest bladder calculi. These may be too small to be detected by x-ray but may be seen, crushed, and evacuated through the cystoscope. Cystoscopy is not recommended as a routine procedure.

Methods of Bladder Drainage

To prevent overdistention, draining of the bladder must be instituted promptly after cord injury. A number 16F Foley catheter is used and changed weekly. Tidal drainage is used with benzalkonium chloride (Zephiran) 1:20,000, normal saline, 0.25 per cent acetic acid, or potassium permanganate 1:10,000, as irrigating solutions. The tidal drainage allows irrigation, periodic distention, and emptying of the bladder. Ureteral reflux is a contraindication to the use of tidal drainage, as infected urine may be forced up into the ureter and kidney pelvis. An indwelling catheter and gravity drainage is the method of choice in the presence of ureteral reflux.

Suprapubic cystotomy may delay the establishment of a reflex bladder and occasionally leads to osteitis of the pubic bone. It should only be resorted to when intraurethral pathology prevents the use of an indwelling catheter. Perineal cystotomy and intermittent catheterization are mentioned only to be condemned.

Complications

The process of attaining a well-functioning reflex bladder is frequently beset by complications, the most important of these are considered in the following discussion.

Urinary Infections — The most common cause of fever in paraplegics is urinary infection. Thus, it is important that the catheter be irrigated and changed if it appears blocked. Adequate fluid intake is essential. Sulfonamides such as sulfisoxazole (Gantrisin) should be given in dosages of 1 gm. four times daily. If there is no response in two days, an intravenous pyelogram should be performed in order to rule out obstructive uropathy. Urine culture and sensitivity tests should be done and the medications indicated by these studies should be used. Pending these reports, wide spectrum antibiotics should be substituted.

Calculi — Immobilization in recumbency reduces the functional demand for laying down of osteoid matrix. The osteoclastic activity continues at its former rate, and the surplus calcium is carried by the blood stream and eliminated through the kidneys. Urinary infection and concentrated urine also predispose to calculus formation. The patient should be up on his feet early, with supportive devices, and any urinary infection treated promptly. Adequate fluid intake (3 to 4 liters daily) should be insisted upon. The urine should be acidified. (Hyaluronidase has proved disappointing in our experience). Bladder calculi may be crushed and evacuated through a cystoscope. Larger, harder stones may require suprapubic cystolithotomy. Calculi in the kidney or ureter causing obstructive uropathy require surgical removal.

Epididymitis — Epididymitis occurs occasionally, especially when catheters are used, but may occur even in the absence of a catheter. Treatment consists of rest, a Bellevue bridge, and antibiotics. With frequent recurrences, epididymectomy may be considered.

Periurethral Abscess and Fistula—Periurethral abscess and fistula occurs fairly frequently and is very often associated with the use of large catheters and with infection. Some fistulae will heal on antibiotics alone administered for 6 to 8 weeks; those that do not are better prepared for surgical repair of the fistula. Opinion differs on the need for suprapubic cystostomy to divert the urinary stream. We prefer suprapubic cystostomy before plastic repair of fistula is attempted because we feel that this will aid in spontaneous healing of the fistula.

Spastic Bladder — Spastic bladder is caused by generalized spasticity with mass reflex, bladder infections, calculi, or decubitus ulcers. The clinical manifestations are extreme discomfort, pinching off of catheter by spastic sphincter, leaking around the catheter, and, in high lesions, severe autonomic phenomena of sweating, flushing, goose pimples, pounding headaches, paroxysmal hypertension (up to 240 mm. Hg systolic blood pressure), and occasionally even convulsions. Munro[7] advocates stretching the bladder with tidal drainage and simultaneously providing temporary abolition of the sacral reflex arc by blocking S3 on one side and S2 and S4 on the other side. Sacral blocks should be repeated at frequent intervals. Meirowsky[19] recommends sacral blocks or spinal anesthesia studies; if these are successful, he advises T12-S5 anterior and posterior rhizotomies. In our experience, a more limited operation, anterior and posterior rhizotomy of S2-S5, was adequate to relieve the symptoms of hypertonic bladder.

Ureteral Reflux — Ureteral reflux is a contraindication to tidal drainage; gravity drainage with manual irrigation should be used instead. Persistent hypertonicity of the bladder may have to be relieved by rhizotomy. Ureterocutaneous implantation may be considered in some cases.

Treatment of Other Complications — Hypertrophy of the internal sphincter is treated by small transurethral resection. For hypertonic external urethral sphincter repeated (8 to 10) pudendal blocks are used. If good but only temporary results are obtained, bilateral pudendal neurectomy with or without transurethral resection may be considered. For urethral stricture gradual dilatation is recommended. If stricture cannot be dilated adequately, suprapubic cystostomy drainage should be used instead of an indwelling catheter. Hypertrophy of the prostate, which may interfere with emptying of the bladder, is treated by prostatectomy.

Bladder Training

When cystometric examination shows a return of detrusor tone with good emptying contractions, bladder training is started. The aim in spinal cord injuries with complete transection above the level of the conus is to develop a reflex bladder. A satisfactory end result is achieved with a capacity of about 300 cc., emptying with a residual of less than 20 per cent and the ability of retention for three hours or longer between voidings.

A fluid intake of about 300 cc. every hour is maintained from 7 a.m. to 7 p.m. No fluids are given after 7 p.m. The catheter is clamped off for one and a half hours, day and night. Tidal drainage at night is used by some in the early phase of bladder training. The time interval is increased gradually over a period of weeks to 3 hours. When a patient can go for 3 hours without leaking around the catheter, the catheter is removed. The patient is then asked to void every hour and a half. Different positions should be used by the patient until he finds the one that gives him the most complete emptying. Some patients find that they can empty their bladders best by half rising in their wheel chairs and pressing down on the arm rests. The tightening of the abdominal muscles increases the intra-abdominal pressure and leads to a more complete emptying of the bladder. Facilitation by rubbing the suprapubic region or the upper medial thigh may also be helpful. The time interval is again slowly increased until

the patient is able to go 3 hours without voiding during the day.

Because many of these patients are trained to move their bowels at night, emptying their bladder completely at the same time, and because of the elimination of fluids after 7 p.m., the interval between voidings during the night may be longer than during the daytime, and some patients may go through the night without voiding. Many patients wear a rubber urinal because of fear of possible embarrassment, although able to go for 3 or 4 hours between voidings.

In conus or cauda equina injuries the sacral-reflex arc is lost, hence a reflex bladder cannot be established. In these cases external pressure on the bladder, the so-called Credè technic, is used to accomplish emptying.

Summary

The mechanism of micturition and its pathophysiology in patients with spinal cord injury have been analyzed. Method of urological examination and treatment of the neurogenic bladder have been outlined. A bladder training program has been presented.

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The Influence of Vibration on Temperature and on the Clearance of Radioactive Sodium in Human Subjects

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In this study we have attempted to determine the effects of vibration on temperature of skin, subcutaneous tissue, and muscle, and sodium clearance from skin and muscle of human subjects.

Method

All subjects in these experiments were out-patients in the Department of Physical Medicine at the Mount Sinai Hospital, New York City. The subjects varied in ages between 28 and 72 and were selected at random.

Thermocouple Studies: All experiments in which temperatures were measured were performed in a room in which the temperature was maintained between 75 to 78 F. Patients were placed at rest in the room for at least 15 minutes before any determinations were made.

Skin, subcutaneous, and muscle temperatures were taken with either a Micromax or a Taylor string galvanometer thermocouple. The temperatures were permitted to stabilize before any procedure was undertaken. The apparatus used for the production of vibration consists essentially of an unbalanced motor suspended within its housing so as to create a variable, multidirectional arc force of changing magnitude. A control knob permits the setting of the frequency at 1,200 to 12,000 cycles per minute. This apparatus is placed within a table, pad, or hand-supported instrument. In these experiments, maximal vibration frequency was used throughout.

In series 1, the torso and lower extremities of the body were caused to vibrate by being placed on a vibration table for 20 minutes. During the experiment, temperatures were taken of the skin of the calf and of the first toe of the foot in each leg. The thermocouple on the calf was placed directly adjacent to but not touching the vibrating device.

In series 2, the sole of the foot was placed in contact with a pad vibrating device and kept in place while the temperature of the skin of the first toe, the dorsum and the sole of the foot, and the skin of the calf was taken. After stabilization of temperature, the vibrator was turned on at full power for 15 minutes. The temperature in these same areas was again taken after vibration.

In series 3, the leg of the subject was placed on a vibrating pad. Temperature determinations were made of the skin of the calf directly adjacent to the vibrator, of the subcutaneous tissue of the calf just adjacent to the device, and of the muscle of the calf near the vibrator. These were recorded at 3-minute intervals before, during, and after the experiment.

In series 4, the patient was placed in the prone position. After stabilization of temperature, a hand vibrating device was applied to the lumbosacral area. The temperature of the skin of both calves was taken at 2-minute intervals before, during, and after vibration.

In series 5, the patient was placed in a supine position. After stabilization of temperature, the calves of both legs were subjected to moving vibration with a hand vibrator for 30 minutes. Temperature of the skin of the left calf was taken at the end of the vibration period and 15 minutes after cessation of vibration. On a subsequent day the same procedure

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was repeated on the same patient, except that the vibrating device was not turned on. The standard deviation of the temperature measuring technic is 0.28 C.

Sodium Clearance Studies: The sodium clearance experiments were made in skin and muscle. All subjects rested in the supine position for 20 minutes before anything was done. In the skin studies, 0.05 cc. of isotonic sodium chloride solution, containing 1 to 1.5 microcuries of radioactive sodium (Na^{24}) was injected intracutaneously, using a 25-gage needle. Care was taken to prevent leakage onto the skin through the needle tract. A light weight Geiger counter was strapped loosely to the area over the site of the injection. The radioactivity was recorded on an automatic register at 1-minute intervals. After 5 to 10 minutes, the Geiger counter was removed and the vibrating device applied to the area for 5 minutes. Following this period the counter was reapplied to the identical area and the clearance rate was determined again. The clearance half-life (the time taken for the activity initially present to be reduced to one half) was found by plotting the data on a semilogorithmic graph for before and after vibration. The clearance constant (K) was calculated from the clearance half-life by the formula: the natural logorithm of 2(0.693 $Min.^{-1}$) divided by the clearance half-life. In earlier reports,[1, 2] we determined standard deviation based on three studies of Na^{24} clearance in the same subject; two subsequent studies of the individual fell well within the range of the average plus or minus twice the standard deviation. We also found that if a $\pm$ 20 per cent error was arbitrarily assigned to a determination, subsequent determinations in the same subject would fall within the range so established. In this study we have determined significance on this basis.

In series A, the vibrator was moved by hand over the injected area. Percentage increase in the clearance rate was determined by dividing the clearance constant for the time following vibration by the clearance constant for the time preceding vibration. In series B, the same technic was used except that the vibrator was maintained in a stationary position over the injected site.

In series C, the patient was placed in a prone position and a vibrating device was applied to the lumbosacral area for 10 minutes. Clearance of Na^{24} from the skin of the calf was taken before, during, and after vibration.

In series D, the sole of the foot was placed in contact with a pad vibrator with the subject in a seated position. Clearance from the skin of the calf was found. The vibrator was then turned on for a 10-minute period, and clearance was determined during the vibration.

In the muscle studies, series E, 0.1 cc. of isotonic sodium chloride solution containing 1 to 3 microcuries of Na^{24} was injected into the belly of the gastrocnemius muscle. A 22-gage, 1-inch needle was used; the needle was inserted to the hilt in order to approximate the same depth of injection in the same subject in all studies. The Geiger counter was then strapped to the leg and the radioactivity present was recorded on an automatic recorder at 1-minute intervals for 55 minutes. Two control studies were taken in each subject. Following these studies, two experiments were performed on the same subject, in which vibration was applied to the calf for 30 minutes prior to the injection of Na^{24}. Two experiments were then performed on the same subject with the vibrating device applied to the calf during the determination of Na^{24} clearance. The results were then plotted on a semilogorithmic graph and analyzed according to the method described by one of us (L.H.W.).[1]

In series F, the temperature of the skin of the calf or of the deltoid area was measured at the same time as Na^{24} clearance from the same area was determined. The temperature of the vibrating device was also taken. Vibration of the skin area was then started and continued for 5 to 10 minutes. Temperatures of the device and of the skin were taken at 1-minute intervals for the duration of the vibration period.

Results

Thermocouple Studies: In series 1, in which 10 subjects were tested while lying

supine on a table vibrator, the temperatures of the skin of the toes increased slightly in 7 of 20 extremities tested. The temperature of the skin of the calves increased in 12 of the 20 extremities. If twice the standard deviation is used to determine significant changes, the rise in skin temperature was significant in 3 toes and 2 calves in 20 experiments. The average increases in the temperature of the toes and calves were 0.25 C. and 0.39 C. respectively.

In the second series of experiments, in which the foot was placed in direct contact with the device, the skin temperature of the calf and first toe, dorsum, and sole of the foot was taken. The temperature of the toes increased in 12 of the 20 subjects; 7 showed a decrease in temperature and one showed no change. If increases less than twice the standard deviation are excluded, the rise in the toe skin temperature was significant in 2 of the 20 subjects. The average increase for this entire series was 0.2 C., which is within the standard deviation of the technic.

The skin temperature of the sole of the foot, which was in contact with the vibrating device, showed an increase in 19 of the 20 subjects. There was an increase beyond twice the standard deviation in 10 of the 20 subjects tested. The average increase in temperature of all subjects was 0.8 C., which exceeds the value for twice the standard deviation (0.56 C.).

In the dorsum of the foot, which was not in contact with the vibrating device, the temperature of the skin increased in 11 of the 20 subjects tested; 5 showed no change, and 4 showed a small drop in temperature. Seven subjects of 20 tested showed a significant increase in skin temperature of the dorsum of the foot. The average increase in temperature was 0.4 C.

In the same experiment, the skin temperature of the calf was taken while the foot was in contact with the vibrating device. In 4 of 10 subjects there was a small increase in temperature; however, only two subjects showed significant increases. Five of 10 subjects showed no change, and in one subject the skin temperature of the calf decreased. The average increase was 0.24 C., which is less than the standard deviation.

In the third series, in which the leg was vibrated, the temperature of the skin, muscle, and subcutaneous tissue was taken as close to the vibrating device as possible. In all 15 subjects tested skin temperature rose; 10 of these rises were statistically significant. The average increase in skin temperature was 0.9 C.

The temperature of the subcutaneous tissue showed an increase after vibration in all 13 subjects tested. If twice the standard deviation is used as a test of significance, 8 of the 13 subjects showed significant increases. The average increase was 0.7 C.

When the effect of vibration on muscle was measured, 12 of the 15 subjects showed an increase in temperature subsequent to vibration; however, only one of the 15 showed a significant increase in temperature. The average increase in muscle was 0.27 C., which is within the standard deviation of 0.28 C.

In the fourth series of experiments, in which the lumbosacral area received vibration, the temperature of the skin of both legs was taken before and after 15 minutes of vibration. In 12 normal subjects, the temperature increased in 20 of 24 extremities tested; two of these increases were significant. The average increase was 0.4 C.

In series 5, in 10 experiments on 10 subjects, skin temperature increased immediately after moving vibration to the calves in all subjects. All of these increases were well beyond twice the standard deviation. The average increase in temperature was 2.2 C. In the second part of this series, in which the vibrating device was not turned on but the procedure was otherwise identical, 10 experiments were done on 10 subjects. In only one of the 10 was there a significant increase in skin temperature, and only three showed any increase. In 6 experiments skin temperature dropped. The average decrease for all 10 experiments was 0.4 C. There was tendency to return toward starting skin temperatures after cessation of application of the nonvibrating device (table 1).

Table 1: Skin Temperature of the Calf Before and After the Use of the Hand Vibrator (Series 5).

Subject	Temperature					
	Prior to Vibration	After 30 Min. Vibration	15 Min. After Cessation of Vibration	Prior to Rubbing with Vibrator	After 30 Min. Rubbing with Vibrator	15 Min. After Cessation of Rubbing with Vibrator
A. B.	31.2	32.1	31.0	28.2	26.7	27.5
J. K.	27.0	28.5	28.0	27.8	28.3	28.3
C. M.	27.0	29.2	27.7	23.5	23.7	23.7
N. L.	26.0	28.0	27.2	25.5	24.5	25.5
M. C.	25.3	29.0	28.5	28.2	28.5	28.0
C. K.	27.6	29.5	28.7	27.5	28.5	29.0
A. A.	26.0	29.0	27.6	28.7	27.6	27.3
A. M.	28.8	29.5	28.5	29.0	28.2	28.2
F. C.	28.2	30.7	28.0	25.0	24.0	24.5
E. J.	26.6	29.5	28.5	25.7	25.1	25.1
Average	27.2	29.4	28.4	26.9	26.5	26.7

Sodium Clearance Studies: In series A, sodium clearance rates were determined in the skin before and after moving vibration. Eighteen experiments were done on 15 subjects. In 13 experiments the clearance rate increased, in four experiments on two subjects there was no change, in one experiment the rate decreased 28 per cent. If an arbitrary range of ± 20 per cent is considered to be inherent in the technic,[2] and any increase less than 20 per cent is excluded as not significant, 12 of the 13 increases were significant. The average percentage increase in clearance rate after vibration was 63 per cent.

In series B, sodium clearance rates were found in the skin before and after stationary vibration; 10 experiments were done in 7 subjects. In 8 experiments the clearance rate increased, in one experiment there was no change, and in one experiment the rate decreased 8 per cent. If rises in clearance rate of less than 20 are excluded, the increase was significant in 7 experiments. The average percentage increase in clearance rate was 166 per cent. If all the skin experiments in series A and B are considered together, the average increase after vibration of the skin was 86 per cent.

In series C, Na^{24} clearance from the skin of the calf was determined before and during application of vibration to the sole of the foot in 10 subjects. The clearance rate increased during vibration in 6 subjects, did not change in 3 subjects, and fell in one subject. If the arbitrary figure of ± 20 per cent is used as the value for twice the standard deviation, then only 3 subjects showed a significant increase in clearance rate. The average increase in clearance rate for the 10 subjects was 39 per cent.

In the muscle studies, series E, clearance rates after and during vibration were compared in the same subjects with control clearance rate studies; 26 experiments in 5 subjects were done. Two of 8 experiments done subsequent to vibration showed significant increases. The remaining 6 studies showed small increases or decreases as compared with the control, but were within the expected ± 20 per cent range of the control. One of the 8 experiments done during application of vibration to the calf showed a significant decrease in clearance rate. The remaining 7 determinations were within the expected range of the controls. The results were negative, in general, that is, vibration applied to the calf had no consistent influence on the clearance of Na^{24} from the muscle.

In series F, in which temperature measurements and Na^{24} clearance were done at the same time, 11 experiments were performed on 10 individuals. A significant rise in temperature occurred in 8 of the 11 experiments; the temperature fell in one of the experiments. The average increase for the 11 experiments was 0.9 C. In the 11 experiments, 8 showed significantly increased rates of clearance, one showed no change, and one showed a decrease in the clearance rate. The average increase in the clearance rate was 82.1 per cent. At no time

Table 2: Effect of Hand Vibrator on Skin Temperature and Na^{24} Clearance in the Same Area (Series F).

Subject	Skin Temperature				Clearance Constant (K) Min. $^{-1}$			Temperature of Vibrator	
	Prior to Vibration	After 5 Min. Vibration	Increase After Vibration		Prior to Vibration	After Vibration	Increase	Prior to Vibration	After Vibration
	C.	C.	C.	%	K	K	%	C.	C.
C. M.	28.5	29.0	0.5	1.8	.049	.059	20.4	28.4*	29.0
A. M.	29.0	31.5	1.5	8.6	.277	.277	0	27.5	31.0
C. B.	29.3	31.8	1.5	8.5	.033	.041	23.5	29.3*	31.3
C. B.	29.2	30.2	1.0	3.5	.031	.035	12.8	25.3	29.5
J. D.	32.0	31.0	−1.0	−3.1	.087	.346	298.0	28.0*	30.2
M. D.	28.6	29.4	0.8	2.7	.048	.064	33.4	28.0*	29.0
L. B.	29.1	30.7	1.6	4.0	.016	.044	175.0	26.5	29.5
G. M.	30.0	31.5	1.5	5.0	.016	.036	125.0	28.5*	30.5
J. A.	31.2	32.1	0.9	2.8	.043	.040	−7.0	29.5*	31.0
D. M.	31.4	32.4	1.0	3.2	.031	.074	139.0	29.1*	32.2
S. C.	29.0	29.5	0.5	1.7	.034	.062	82.5	29.0*	29.5
Average	29.8	30.8	0.9	3.3	.060	.098	82.1	28.1	30.2

*Device was run for 15 minutes prior to its application to the skin.

was the temperature of the vibrating device higher than that of the skin. In all experiments the temperature of the device was lower than that of the skin at the start of the procedure. In all experiments the temperature of the device increased, but in only two did it reach the same temperature as that of the skin. On the average, the temperature of the device was 0.6 C. less than that of the skin at the end of the vibration period (table 2).

Comment

In reviewing the results of these experiments, it becomes evident that vibration with these devices results in an increase in skin temperature and in Na^{24} clearance in the area that is in direct contact with the vibrating device. In series 1 there was a small effect on the average in all areas but one. When these results were noted, investigation of the particular device used throughout showed that this area (in contact with the right leg) had little or no vibration energy as compared with other areas of the same device. The influence of vibration at a distance from the area being vibrated is questionable. In the second series, it was noted that the largest effect of vibration is in the area (the sole of the foot) which was in direct contact with the device; the skin of the big toe, the calf, and the dorsum of the foot showed increased temperature on the average, but these changes were not significant statistically. In comparing the distant effect of foot vibration in the skin of the calf both in temperature and Na^{24} clearance, there is a fair degree of correlation. The average increase in Na^{24} clearance was 39.6 per cent; however, this figure depends in a large part on one of the 10 experiments in which the increase in clearance rate was 212 per cent. If this single experiment is eliminated from the calculations, the average percentage increase is just at the upper level of the $\pm$ 20 per cent range of the Na^{24} clearance technic. The average rise in skin temperature of the calf in series 2 was 0.24 C., which is less than the standard deviation. Furthermore, if significant increases in skin temperature and skin Na^{24} clearance are considered, only 2 increases in temperature of the 11 subjects tested are significant and only 3 increases in clearance rate in 10 subjects are significant. Vibration to the lumbosacral area resulted in some small effect at a distance, in the calves; however, rises in temperature were significant in only 2 of the 24 subjects tested, and the average increase was less than twice the standard deviation. The same method of vibration was also used for measuring Na^{24} clearance. In these experiments there were no significant changes. Thus, there is little if any effect of vibration at a distance from the area receiving vibration. This conclusion is also supported by the experiments in series 3. The skin in direct contact with the device and

subcutaneous tissue just below showed similar and significant average increases in temperature whereas the deeper muscle tissue showed an insignificant average increase in temperature. The experiments in series A, B, and E also support the conclusion that vibration has an effect only on tissue in direct contact with the device and that the deeper muscle tissue is essentially unaffected.

When the effects of a table vibrator, pad vibrator, and hand vibrator (series 1, 2, 3, 5) on the temperature of the skin in direct contact with the device were compared, the greatest effect was found to be with the use of the hand vibrator. The largest average increase in temperature with the table vibrator was 0.5 C., with the pad vibrator 0.9 C., and with the hand vibrator 2.2 C. Although the period of time of application of the vibrating devices varied in the reported studies, several unreported studies were done using the same time periods. The results were similar to the studies reported here. In series A and B, the effect of moving and stationary hand vibration was compared. Stationary vibration had a larger effect on sodium clearance. This may be explained by the fact that during stationary vibration the vibrator is constantly present over the area, whereas in moving vibration, the vibrator is outside of the area being tested for an appreciable period of time.

It occurred to us that the effects of vibration on temperature and sodium clearance might be a result of the heat generated by the motor of the device. The experiments in series F show that the heat of the device is not a factor. In these experiments the temperature of the device was consistently below that of the skin; if any transfer of heat takes place, it is in the direction from the skin towards the device. In order to make certain that this was true, the vibrating device was allowed to run 15 minutes before being used. It did in fact increase in temperature in this warm-up period, but was always less than that of the skin. Since the device is of metal and poikilothermic, it could not give off heat to the skin.

In order to determine whether or not there was a peculiar effect of vibration as contrasted with merely rubbing the skin with the nonfunctioning device, the experiments in series 5 were performed. As can be seen from the results, mere rubbing with the nonfunctioning device resulted in a fall in temperature and drew heat from the skin. When the same procedure was followed with the device functioning, skin temperature increased significantly.

In comparing the results on temperature changes and Na^{24} clearance done in the same person at the same time, it becomes clear that there is a vague qualitative agreement but no quantitative agreement between the two methods.

Summary

Vibration with these devices increases the temperature of the skin and subcutaneous tissue and rate of sodium clearance from the skin in contact with the vibrating device. The effect of this vibration on skin temperature and sodium clearance in an area at a distance from the device is minimal. Such vibration has little or no effect on temperature of and sodium clearance rate from muscle.

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Amputees in Industry

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A worker is judged and placed in industry on the basis of his ability for a certain job. His inability to do other jobs is completely irrelevant. In evaluating the disabled person for job placement this primary principle should be kept foremost in mind.

At the annual meeting of the American Congress of Physical Medicine and Rehabilitation in 1955, I presented a film entitled "Amputees In Industry." This film was a documentary case history study of five amputees, showing in each case the amputation stump, the prosthesis, and finally the patient at work in industry. The narrative remarks that accompanied the film are paraphrased in the following report.

The amputation clinic at Henry Ford Hospital in Detroit is not a large one; therefore, the purpose of this film was not to demonstrate methods of treatment of amputees, nor even specifically to demonstrate methods of selective job placement for amputees. The film is made mainly to allow the trained observer to witness the details of operation of prostheses in industry.

The amputees shown in the film were selected against the background of experience of a joint orthopedic-physical medicine clinic during the year and a half preceding this survey. The experience included 28 upper-extremity amputees; 22 of these were below-elbow amputations; 24 were caused by punch-press operation. At the time of survey, 26 of these 28 upper-extremity amputees had been reemployed on a full time basis. One of the unemployed was still receiving medical care, and the other had elected voluntary retirement at the age of 63 rather than return to work. Only in a small minority of cases had it been possible to replace the patient in his original job after amputation of the upper extremity.

There were 47 amputees in the lower-extremity group. Of these, 25 had above-knee amputations; this included two bilateral above-knee amputations. The major cause of lower-extremity amputation was arteriosclerosis obliterans. Of the 47 lower-extremity amputees, 23 were employed at the time of survey. Of the 24 remaining unemployed, 16 were still receiving treatment, and 7 had elected retirement. A larger number of the rehabilitated lower-extremity amputees were able to return to their original occupation.

Average age was 28 years for the upper-extremity group and 49 years for the lower-extremity group. Case histories on the five patients selected from this group to be shown in the film are described in the following discussion.

Bilateral Below-Elbow Amputation

A 26-year-old production worker who had worked for a year and a half sorting material as it came from a press lost both hands in the press. He has bilateral medium below-elbow stumps, with a greater amount of rotation and flexion range in the left stump than in the right; however, since he was predominantly right handed at the time of his accident, he continued to use the right sided prosthesis as the dominant one. He is fitted with bilateral standard below-elbow prostheses with a socket constructed of laminated plastic, with bilateral Northrop-Sierra two-load hooks and manual friction disconnecters. The socket is attached through a triceps pad to an inverted Y-strap and a standard bilateral below-elbow harness across the posterior portion of the shoulders.

Since the patient works in a grease-free environment, difficulty in maintaining cleanliness of mechanical parts did not enter into the choice of terminal device. As a materials handler (inspection) the patient did not have to do

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heavy work, so that this was not a factor of choice. A Northrop-Sierra voluntary opening two-load hook was chosen in this case and in another presented here primarily because of immediate convenience and availability and the absence of specific indications for other types of hook. Army Prosthetics Research Laboratory (APRL) hooks or Dorrance No. 6 hooks might just as easily have been used. The manual friction disconnect was used because of mechanical convenience of operation for the bilateral amputee. The triceps pad is less bulky and restricting than corresponding arm cuffs, and was chosen for that reason.

The patient's job is presently that of inspecting inside door panels in a major automobile plant. He picks the panel up with both prostheses and visually inspects it closely. If he finds a defect he must reach into his pocket with a prosthesis, procure an inspection tag, write the defect on the tag with a pencil also procured from his pocket, and then tie the tag to the defective material. He must also record the defects on a clip board, again using a pencil.

It should be noted that this patient has been a much improved worker since the time of his accident. It is reported that he previously did not seem to take anything seriously. Since his return to work with his prosthesis, he has been a much more stable worker.

Bilateral Above-Knee Amputation

A 40-year-old man was well until about a year and a half prior to the time of this survey, when insidious gangrene developed in the right lower extremity. The gangrene progressed despite a lumbar sympathectomy on that side and it was necessary to perform a supracondylar amputation. Within a week after the amputation on the right, gangrene developed in the left lower extremity; this was subsequently amputated at the knee disarticulation level. Despite the patient's relative youth, the diagnosis on both postoperative specimens was arteriosclerosis obliterans. Stump exercises were begun on the right within a day or two after amputation, and hip exercises on the left about one week prior to amputation.

The patient made rapid progress: within six weeks after the second amputation he was fitted with a standard suction socket on the right (Callendar) and a knee disarticulation prosthesis on the left. Within 6 weeks after the fitting he was walking easily with double Lofstrand canes on level surfaces and was beginning to negotiate stairs.

The knee disarticulation prosthesis on the left has proved very satisfactory with this man. He has not been bothered by the "long thigh" trouble often attributed to the knee disarticulation prosthesis. This was obviated by adequately lengthening the suction socket prosthesis to equalize the thigh lengths. The patient's gait is smooth with the exception of a minimal external rotation whip during the swing phase of gait on the suction socket side, a factor that was felt to be of habit origin and that could not be eliminated by training. A slightly faster swing of the lower leg was noted in ambulation on the left because of the lack of friction in the disarticulation prosthesis hinges.

This patient was put back to work on the assembly line in a semi-ambulatory job. It is still necessary for him to walk from the parking place at the plant to his place on the line. He also walks up and down 28 steps to his apartment daily. He has been assigned the job of license plate bracket assembler, and is quite capable of keeping up with his colleagues. During the first year after his return to work he missed only one day. He has equipped his prostheses with crepe soled shoes, an unusual innovation since some amputees feel that rubber soles trip them. He feels that they give him increased traction.

Unilateral Above-Elbow Amputation

A 30-year-old press operator in June, 1948 lost his arm in the press at the above-elbow level. At that time he was provided with an above-elbow prosthesis, but was given no training in its use; therefore, he did not use the prosthesis, and was returned by his employer in 1954 for refitting and for upper extremity prosthetic training.

At the time of refitting, the patient was provided with an above-elbow pros-

thesis with APRL hand, APRL cosmetic glove, manual friction disconnects, laminated plastic forearm of standard plan, Northrop-Sierra model C elbow, and double wall socket. A standard figure-8 harness was prescribed, but the patient had previously used a chest strap harness and insisted on this in the second prescription. It was also at his insistence that an APRL hand was prescribed instead of the far more efficient hook; he prefers the cosmetic to the functional advantages. The prescribed prosthesis has a dual control system, one for control of the elbow and the other for flexion of the forearm or operation of the terminal device, depending on the status of the elbow lock. The above-elbow stump is of adequate length and has excellent range of motion and strength.

The patient was placed as a clerk in the production division of a major automobile plant. He was originally a right-handed dominant individual, but has switched to left-handed dominance. His job involves such maneuvers as stamping dates on successive papers. For this operation he uses the prosthesis as an automatic stamper, with the left hand dextrously shifting the pieces of paper beneath the stamper.

His use of the prosthesis is not as great as would be hoped, and probably reflects the long period of unilateral activity between 1948 and 1954. He uses the prosthesis routinely to turn a pencil sharpener, and uses it as a resting place for papers while doing filing activities.

Unilateral Below-Knee Amputation

A 40-year-old maintenance man in an automobile plant was struck in the leg by a Hi-lo truck about 18 months prior to this survey. He had severe compound fractures of the tibia and fibula on the left necessitating immediate guillotine amputation. This was followed in about 5 weeks by a revision and 5 weeks later by fitting of a prosthesis. Within 6 more weeks the patient was back on his job.

The patient had a good, functional-length below-knee stump. He was fitted with a standard below-knee prosthesis with metal side bars and hinges at the knee attached to a thigh corset. During the early training stages the patient limped noticeably. This limp disappeared when his cadence was increased to 120 paces per minute or greater. It was found later that the patient was accustomed to walking fast. Early piston action in the stump was partially corrected by the use of a fairly tight kick strap. In spite of a moderate quiver in the quadriceps and hamstring groups during manual resistive muscle testing, the patient's gait remained smooth and his ability to get up and down from a chair was unhampered.

Fortunately the patient could be returned directly to his old job. He had worked for many years as a maintenance man on heavy, stationary machinery. After the prescription and fitting of his prosthesis he was quite able to climb ladders and perform all of the intricacies of inspection work. (Safety precautions at the plant forbid him to climb ladders). In walking to and from his place of work he climbs five flights of steps easily.

Unilateral Below-Elbow Amputation

The oldest patient in this small survey group was a 45-year-old man who lost his left hand at the medium below-elbow level in a press accident early in 1954. A self-assertive and dynamic individual, he insisted on exacting fit and perfect function of his own prosthesis throughout training. He had excellent range, strength, and rotation in his forearm stump.

The prosthesis prescribed for him consisted of a laminated plastic socket, a Northrop-Sierra two-load hook with manual wrist disconnect, and a single control cable through a triceps pad to an inverted Y-strap and a figure-8 harness.

This patient had worked for several years prior to his accident as a steam hammer man. He is now assigned to the operation of an electric furnace in the forge of an automobile plant. The temperature of the furnace is in the neighborhood of 2200 F., and the white hot steel forgings that he manipulates weigh about 55 kg. (120 lb.). His job is to watch the controls of this furnace and at the proper time to reach into the furnace with an 8-foot metal rod and

guide the forging to its ultimate destination on a conveyor belt. The patient has found the prescribed prosthesis excellent for this assignment.

Summary

Case histories of five amputees who were fitted with prostheses and returned to work in heavy industry are discussed. These patients, representative of a large group of such amputees, were selected for a documentary film designed primarily to demonstrate to the trained observer the details of operation of prostheses in industry.

Acknowledgement: Appreciation is expressed to Dr. C. Leslie Mitchell, Chief, Division of Orthopedics, Henry Ford Hospital, for his help and guidance in the production of this film. The excellent direction of Miss Helen Powell, O.T.R., and expert photography of Mr. John Kroll are equally appreciated. We recognize also the kind cooperation of the Fabricon Products Corporation, the Chrysler Corporation, and the Ford Motor Company.

This film is obtainable for loan through Dr. Mitchell on request. The film has an optical sound narrative.

The officers of the American Congress of Physical Medicine and Rehabilitation, the American Academy of Physical Medicine and Rehabilitation and the Editorial Board of the ARCHIVES extend to all members, readers, advertisers and friends, their very best wishes for a Merry Christmas and a Happy New Year.

physical medicine abstracts

Human Cerebral Blood Flow and Oxygen Consumption as Related to Aging. Seymour S. Kety. J. Chron. Dis. 3:459 (May) 1956.

The author reviews available information on cerebral blood flow and oxygen consumption in man obtained by means of the nitrous oxide technic.

Apparently there is a rapid fall in over-all cerebral circulation at the time of puberty which continues through adolescence. From the third decade on there is a more gradual but continuous decline in this function. There is a very similar relationship between cerebral oxygen consumption and cortical neurone density and aging. Cerebrovascular resistance on the other hand increases with age.

The distinction between a primary circulatory or primary metabolic deficiency in the aging brain cannot be made at this time. The relationship between arteriovenous oxygen difference and aging should be further investigated since this study might provide further information on the dynamics of the aging brain.

Adduction Contracture of the Thumb. J. Edward Flynn. New England J. Med. 254:677 (Apr. 12) 1956.

The author points out that a hand with an adduction contracture is greatly disabled. It is unable to perform its chief functions of pinch and grasp.

The commonest causes of this deformity are trauma and burns. Illustrative cases caused by crushing injuries, an avulsed wound and ischemia, war wounds, a dislocation, deep thermal burn, and birth injury to the brachial plexus are presented.

Although the author states that the deformity can usually be prevented by proper splinting, no mention is made of the uses of massage, stretching, and exercise.

His chief interest is in those cases which do not yield to preventive measures and subsequently require surgery. Surgical measures discussed are excision of scar and grafting, excision of deep tissues such as muscle, the use of a bone strut, Kirchner wires, and tendon transplants.

The author implies but does not state explicitly that these deformities are preventable if physical therapy is instituted early.

Subacute Combined Degeneration of the Spinal Cord. Current Concepts of the Disease Process. Value of Serum Vitamin B_{12} Determinations in Clarifying Some of the Common Clinical Problems. Maurice Victor, and Arnold A. Lear. Am. J. Med. 20:817 (June) 1956.

It is difficult to make an early diagnosis of subacute combined degeneration. The difficulty is frequently due to the lack of parallelism between the hematologic and neurologic manifestations. Widespread use of folic acid has increased this lack of parallelism. With the use of folic acid the neurologic signs may progress to an irreversible stage while the hematologic findings are improved. Subacute combined degeneration of the spinal cord due to pernicious anemia may be difficult to distinguish from intrinsic disease of the spinal cord and from other macrocytic anemias and their associated neurologic disturbances.

In all these clinical problems estimation of vitamin B_{12} in the serum may be an aid in diagnosis. B_{12} deficiency occurs regularly in pernicious anemia with or without hematologic and/or neurologic abnormalities. It is very helpful in diagnosis of this disease when the anemia is mild. A method of determining B_{12} in the serum by a microbiologic technic is recommended. An algal flagellate, Euglena gracilis, shows a growth response directly proportional to the amount of B_{12} present, and therefore may be used to estimate the B_{12} content of serum.

Brain Metabolism in Relation to Aging. Harold E. Himwich, and Williamina A. Himwich. J. Chron. Dis. 3:487 (May) 1956.

The author makes the point that biochemical data for the brain in old age are scant. On the basis of the small number of human brains studied it appears that there is a rise in lipid content which is at first fairly rapid, and then slower to 65-76 years of age. Then there is a decrease to 78-90 years of age. Water content shows a converse relationship. The concentration of lipid becomes larger as the total fluids fall and this fall in fluid is due chiefly to the extracellular component. Whether or not a reversal of this relationship—a fall in lipid concentration and increase in water—really takes place in the aged (78-90 year group) cannot be determined without additional data.

Protein content increases with aging until the third or fourth decade and decreases from the sixth decade on. This decrease may explain the decrease in total brain metabolism.

X-ray microradiography reveals a decrease in pentose nucleic acid concentration in old age while there is a concomitant accumulation of yellow pigment.

Pyruvic acid and alpha-ketoglutaric acid show a relatively stable concentration throughout the life span of the rat. Glutamic acid and glutamine are present in lesser concentration in the aging rat.

The significance of these changes is not known at present.

The Combined Effects of Chlorpromazine and Pentobarbital on Cerebral Hemodynamics and Metabolism. Joseph F. Fazekas; Salomon N. Albert, and Ralph W. Alman. Am. J. M. Sc. **231**:655 (June) 1956.

Relatively large doses of pentobarbital combined with moderate amounts of chlorpromazine were administered to seven patients. Before and after this administration electroencephalograms were made plus studies of cerebral hemodynamics and metabolism. After administration of pentobarbital, characteristic electroencephalographic changes occurred. These remained unchanged or even improved following chlorpromazine administration. "There was a slight diminution of cerebral blood flow and cerebral oxygen consumption after pentobarbital; no interference with cerebral hemodynamics and oxidative reactions was demonstrated when chlorpromazine was also given." All the individuals sedated with pentobarbital showed increased sedation following the administration of chlorpromazine. A combination of the two drugs may be the therapy of choice for the management of refractory hyper-excitable states.

Structural Alterations with Aging in the Nervous System. Warren Andrew. J. Chron. Dis. **3**:575 (June) 1956.

The author reviews his findings and those of others concerning structural changes with aging in the nervous system.

The aging brain is described as lighter in weight, with atrophic gyri and thick meninges. Generally speaking nerve cells become smaller, more ragged in outline, and show an accumulation of lipid material and pigment. Satellite cells tend to increase. The nucleus becomes more basophilic while the cytoplasm loses Nissl substance. The nucleolus becomes paler and is eccentrically placed. Mitochondria and Golgi bodies tend to become less distinct in form while neurofibrillae increase. Apparently dendritic processes also become relatively more numerous.

In addition to these general characteristics there are specific changes. For example, the ventral horns tend to accumulate large amounts of pigment while sensory ganglia show a true fatty degeneration. In certain pathologic conditions the Purkinje cells in man may show amitotic division.

The aging nervous system may also show compensatory or defensive change. Certain hypothalamic nuclei are characterized by amitotic nuclear division as well as formation of giant cells and nucleolar division. These changes may prevent death or degeneration of neurons in the supraoptic and paraventricular nuclei.

Effect of Chlorpromazine on Pituitary ACTH Secretion in the Dog. R. H. Egdahl, and J. O. Richards. Am. J. Physiol. **2**:235 (May) 1956.

Numerous studies have been carried out in an attempt to determine the exact pharmacological effect of chlorpromazine. The authors investigated the effect of various doses of this drug on adrenal function in the dog.

Blood samples were obtained directly from the lumbo-adrenal vein by means of a polyethylene cannula. These were then analyzed for 17-hydroxycorticosteroid content. The chlorpromazine was administered intravenously.

Eight of sixteen animals showed a positive adrenal-cortical response to the chlorpromazine with maximum output attained in from six to twelve minutes. Two of the eight animals with negative responses showed an increased activity when the dosage was increased.

In two animals the effect of chlorpromazine on adrenal 17-hydroxycorticosteroid output was studied before and after hypophysectomy. With the pituitary intact, a marked increase in adrenal steroid secretion was noted following the injection of 50 mg. of chlorpromazine. An equal dose after hypophysectomy produced no demonstrable increase in adrenal steroid output. However, a pronounced adrenal-cortical stimulation occurred in response to 40 U. of ACTH injected intravenously.

The "delayed effect" might conceivably favor the theory of hypothalamic stimulation, but does not exclude the direct action of chlorpromazine on the adenohypophysis.

Care of the Bladder in Neurological Disorders. Herbert S. Talbot. J.A.M.A. **161**:944 (July 7) 1956.

In neurological disorders disturbances of micturition are common. With the following simple procedures the nature of a bladder dysfunction can probably be determined; urinalysis and culture, residual urine determination, observation of voiding habits (frequency and amount), observation of the urinary stream, rectal and pelvic examinations, and neurological examination.

A good discussion is given of management of bladder disturbances in patients with cerebrovascular accidents and patients with diseases of the spinal cord.

The Reflex Responses to Inflation or Deflation of the Lungs and Their Importance in the Regulation of Respiration. J. Garcia Ramos. Am. Rev. Tuberc. 73:519 (Apr.) 1956.

The respiratory responses of rabbits to inflation or deflation of the lung were measured. It was found that there is a definite relationship between stimulus and response. This relationship does not change with anesthesia up to the surgical level or with moderate increase or decrease of oxygen or carbon dioxide tension in the inspired air. "Only with severe reductions in oxygen tension is there a rise in threshold and more marked inhibition to inflation of the lung with large positive pressures; the Hering-Breuer reflex can maintain a level in pulmonary ventilation for indefinite periods of time even if it appears to be a condition of hyperventilation or of asphyxia; the organism adapts itself more easily to changes of the gas tensions in the blood than to the Hering-Breuer reflex." The importance of this reflex may be noted in lung resection, asthma, and emphysema.

The Changes in the Fundus of the Eye in Arterial Hypertension. Herman Elwyn. A.M.A. Arch. Ophth. 55:3 (Jan.) 1956.

There are two different fundus pictures seen in arterial hypertension. One set of findings is due to the slowly progressive changes in the retinal arteries. In the other set is seen an abnormal narrowing of the retinal arteries with secondary changes in the substance of the retina; this constitutes arteriospastic retinopathy. The findings of these separate pictures are described in detail plus pathological and physiological reasons for the occurrence of the findings.

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American Cancer Society

American Academy of Physical Medicine and Rehabilitation

EDWARD L. COMPERE, M.D.

President's Award

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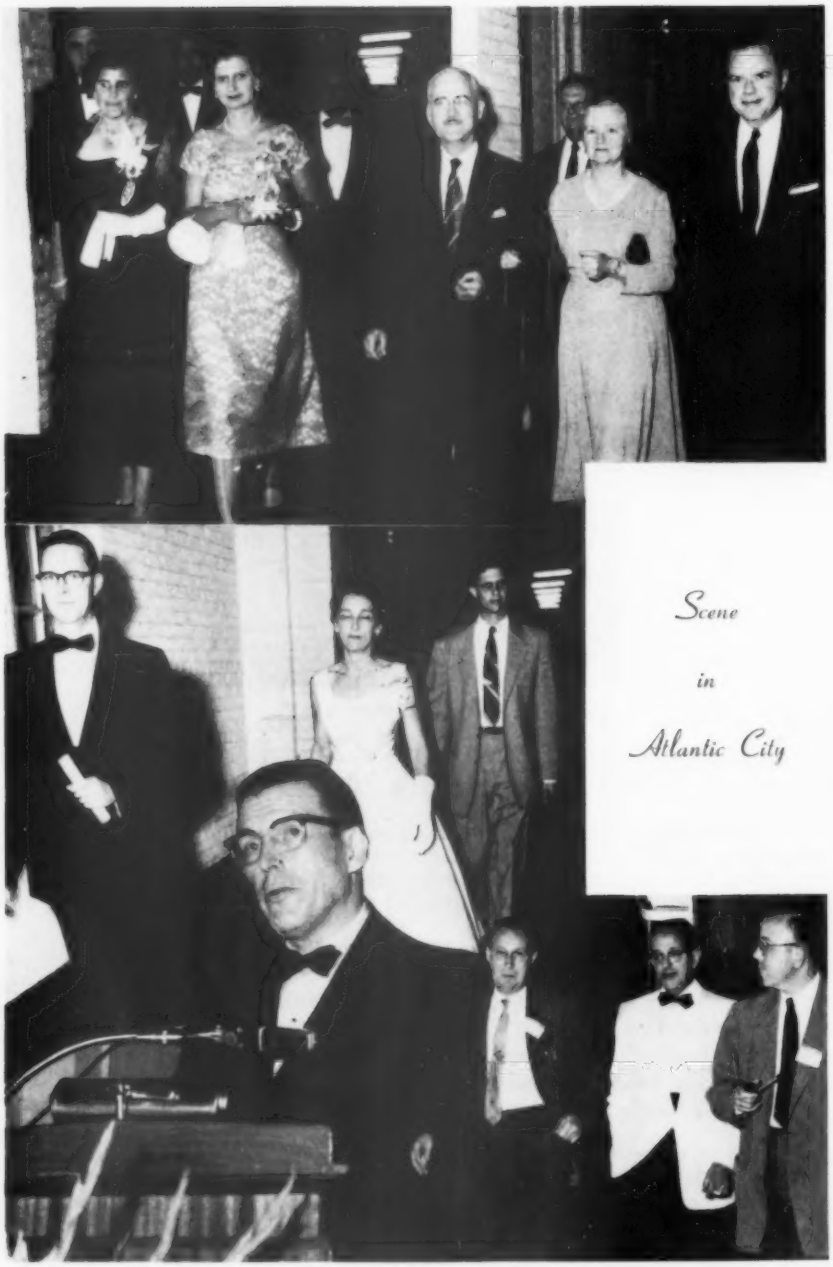
> *"American Academy of Physical Medicine and Rehabilitation assembled in Annual Session, Atlantic City, N. J., September 10, 1956, hereby authorizes the presentation of the President's Award and of this citation to Edward L. Compere, M.D., Chicago, in recognition of his outstanding work in restoring people to health and of his leadership in developing the Liberty Mutual Rehabilitation Center of Chicago."*

Doctor Compere was born in Chickasha, Oklahoma in 1901. He took his formal training at Rush Medical College, Chicago, and was graduated in 1926. He was certified by the American Board of Orthopedic Surgery in 1936 and since that time he has been a leading surgeon and professor in hospitals and universities in the Midwest. At the present time, he is chairman of the Department of Orthopedic Surgery, Northwestern University, Chicago. He is a member of the International College of Surgeons, American Academy of Orthopaedic Surgeons, American Medical Association, American College of Surgeons (Fellow), American Orthopaedic Association, American Rheumatism Association, and the Clinical Orthopaedic Society.



Scene in Atlantic City

Reading across the page, left to right, Mrs. Knudson and Mrs. Martin in the foreground; Doctors Knudson, Rhoads and Martin in the background; Mrs. Jones is being escorted by Dr. Jones with Doctors Weissenberg and Wilson in the party; Dr. Rose is closely followed by Mrs. Rose and Dr. Long; Dr. Rhoads pauses momentarily; Doctors Weaver, Ferderber, and E. Krusen stroll casually to the Renaissance Room.

Reading across the page, left to right, Dr. Martin smiles for the photographer with Doctors Rhoads and Piersol in the background; Dr. Abramson, with unidentified friend, flashes a warm smile; Dr. and Mrs. Knapp are followed by the Congress staff, Mrs. Cwik, Miss Kobza and Miss Calt; Doctors Selke and Gullickson are caught, but not unaware, by the camera; Dr. Martin receives the presidential gavel from Dr. Knudson.

medical news

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1956 Annual Meeting of the American Medical Association held in Chicago this past June: **Louis B. Newman,** Chicago, Chairman; **Miland E. Knapp,** Minneapolis, Vice-Chairman; **Donald A. Covalt,** New York City, representative to the Scientific Exhibit for the ensuing year; **Walter J. Zeiter,** Cleveland, Secretary for the ensuing three years; **Frank H. Krusen,** Rochester, Minnesota, delegate for a two-year term beginning January 1, 1957. **Arthur L. Watkins,** Boston, alternate delegate, was elected in 1955 for a two-year term ending December 31, 1957. — **Constantine G. Psaki** of Philadelphia introduced the use of the electromyogram and its clinical application to the monthly staff conference held on October 18th. Guest speaker was **Francis J. Bonner,** Ardmore, Pa. — Principal speaker at the ground-breaking ceremonies for a new wing at the Elizabeth Kenny Institute in Minneapolis last July was **Frank H. Krusen** of Rochester, Minnesota. — On August 22nd, **Samuel G. Feuer** of Brooklyn co-authored a paper entitled "Limitations of Physical Therapy and Concept of Team-Management of Industrial Low Back," which was presented at the Second International Congress of Physical Medicine at Copenhagen, Denmark. **Doctor Feuer** also spoke before the Kings County Chapter of the National Multiple Sclerosis Society at the Hotel St. George on the subject "Modern Concept and Developments of Multiple Sclerosis." A post-graduate course in physical mdeicine and rehabilitation was instituted by **Doctor Feuer** and his staff on October 4th under the auspices of the Kings County Medical Society and State University of New York, College of Medicine, in the new Rehabilitation Department of the Coney Island Hospital.

Applicants for Congress Membership

Claude W. Garrett, Jr., M.D., VAMTGH, Park Ave. & Getwell Rd., Memphis, Tenn.: Sponsored by Frank J. Schaffer, M.D., Memphis.

Robert M. Krout, M.D., 2 Barrymore Rd., Hanover, N. H.: Sponsored by Thomas P. Anderson, M.D., Hanover, N. H.

Boris J. Paul, M.D., Herbert Dr., Latham, N. Y.: Sponsored by Joshua Ehrlich, M.D., Albany, N. Y.

Joel L. Roth, Major, MC, Brooke Army Hospital, Ft. Sam Houston, Texas: Sponsored by Joseph W. Thomas, Lt. Col., MC, Denver.

Robert P. Smith, M.D., 234 Spear St., South Burlington, Vt.: Sponsored by Arthur L. Watkins, M.D., Boston.

Dorothy M. Stillwell, M.D., 900 W. 27th Ave., Vancouver, B. C.: Sponsored by Gordon M. Martin, M.D., Rochester, Minn.

Andor A. Weiss, M.D., 1645 Grand Concourse, New York City: Sponsored by Alfred Ebel, M.D., Bronx.

David I. Abramson, M.D., 916 Oak Park Ave., Oak Park, Ill.: Sponsored by Max K. Newman, M.D., Detroit.

Mortimer D. Abrashkin, M.D., 1 Lincoln Rd. Bldg., Miami Beach, Fla.: Sponsored by Murray B. Ferderber, M.D., Pittsburgh.

William C. Fleming, M.D., 905 E. 59th St., Richmond, Va.: Sponsored by A. Ray Dawson, M.D., Richmond, Va.

Charles H. Flint, M.D., 718 5th St., S.W., Rochester, Minn.: Sponsored by Gordon M. Martin, M.D., Rochester, Minn.

Earl C. Gluckman, M.D., 130 W. Kingsbridge Rd., New York City: Sponsored by Alfred Ebel, M.D., Bronx.

Heinz I. Lippmann, M.D., 1192 Park Ave., New York City: Sponsored by Arthur S. Abramson, M.D., New York City.

Alexander C. Pinkerton, M.D., 3726 Blenheim St., Vancouver, B. C.: Sponsored by Gordon M. Martin, M.D., and Keith Stillwell, M.D., Rochester, Minn.

Leon M. Rothman, M.D., 2453 Ocean Ave., Brooklyn: Sponsored by Jerome S. Tobis, M.D., New York City.

Scholarships Available for War Orphans

Under the War Orphans' Scholarship Bill recently signed by President Dwight D. Eisenhower, financial assistance for educational purposes will be available to children of veterans of World War I, World War II, and the Korean War who died as a result of service-connected injury or disease.

This Act will be administered by the Veterans Administration. It permits training in any approved college, public or private vocational school, business school or other approved educational institution. Any school approved for Korean veterans under the G. I. Bill is automatically qualified to accept applicants under the War Orphans' Scholarship program. An estimated 160,000 children of deceased veterans are eligible for benefits under it.

Children with mental or physical handicaps are eligible for special training to help them to overcome their disabilities.

Benefits are $110 a month for full-time training, $80 for three-fourths time, and $50 for half time. Eligible children are entitled to 36 months of education and training, which can begin at completion of high school or at age 18 and extend to age 23. When an individual reaches age 23 in the middle of a term he will be allowed to complete the term. Any eligible person who had not reached his or her twenty-third birthday on the date of enactment of this bill is entitled to full benefits. Those over 18 but under 23 or in military service on the date of enactment are given five years in which to complete their training.

No provision is made in the Act for on-the-job, apprentice, flight training, or correspondence study.

NFIP Appoints New Medical Director

Dr. Thomas M. Rivers of New York City, formerly vice-president of the Rockefeller Institute for Medical Research, has been appointed medical director of the National Foundation for Infantile Paralysis, it was announced by Basil O'Connor, president of the March of Dimes organization.

He succeeds Dr. Hart E. Van Riper, who is leaving the National Foundation on October 31 to become medical director of Geigy Pharmaceuticals of Ardsley, N. Y. Dr. Van Riper joined the National Foundation staff in 1945 and became medical director in 1946.

Mr. O'Connor paid tribute to Dr. Van Riper, saying: "All of us regret his departure exceedingly, after eleven fruitful years with the National Foundation. We were fortunate to have had such a dedicated and gifted physician at the helm of the medical department during the crucial years of vaccine development and improved patient care.

"We also are fortunate that, in these years, Dr. Rivers worked closely with Dr. Van Riper, so that the continuity of our still unfinished fight against polio will not be broken."

Books Received

Books received are acknowledged in this column as full return for the courtesy of the senders. Reviews will be published in future issues of the journal. Books listed are not available for lending.

Electrodiagnosis and Electromyography edited by Sidney Licht; **Muscle Testing — Techniques of Manual Examination** by Lucille Daniels, et al; **Proprioceptive Neuromuscular Facilitation—Patterns and Techniques** by Margaret Knott, and Dorothy E. Voss; **Asclepiades: His Life and Writings** by Robert M. Green; **Biology of the Laboratory Mouse** edited by George D. Snell; **Medical Effects of the Atomic Bomb in Japan** edited by Ashley W. Oughterson, and Shields Warren; **Exorcism and the Art of Healing in Ceylon** by Paul Wirz; **A Scientific Report on the Search for Bridey Murphy** edited by Milton V. Kline; **How to Get Industrial and Business Publicity** by C. E. St. Thomas; **Clinical Psychology. The Study of Persons** by Richard W. Wallen; **Ankylosing Spondylitis** by J. Forestier, et al; **The Neurosurgical Alleviation of Parkinsonism** by Irving S. Cooper; **Doctors' Offices and Clinics: Medical and Dental** by Paul Hayden Kirk, and Eugene D. Sternberg; **Diagnosis and Treatment of Peripheral Vascular Disorders** by David I. Abramson; **Athletic Injuries: Prevention, Diagnosis and Treatment** by Augustus Thorndike; **Directory for Exceptional Children: Schools, Services, Other Facilities** edited by E. Nelson Hayes; **Observations on Krebiozen in the Management of Cancer** by A. C. Ivy, et al; **Physical Measures in the Treatment of Poliomyelitis** by Robert J. S. Reynolds; **Hormones and the Aging Process** edited by Earl T. Engle, and Gregory Pincus; **Blakiston's New Gould Medical Dictionary** edited by Norman L. Hoerr, and Arthur Osol; **Principles of Human Physiology** by Sir Charles Lovatt Evans; **Conquest of Disability** edited by Sir Ian Fraser; **Fluid Balance Handbook for Practitioners** by William D. Snively, Jr., and Michael J. Sweeney; **Cerebral Palsy. Advances in Understanding and Care** by Viola E. Cardwell; **Concise Anatomy** by Linden F. Edwards; **Five Hundred Over Sixty. A Community Survey of Aging** by Bernard Kutner, et al; **Campbell's Operative Orthopaedics, Volumes I and II** by J. S. Speed, and R. A. Knight; **Postural and Relaxation Training in Physiotherapy and Physical Education** by John H. C. Colson; **Silent Spokesman. An Aid to the Speechless** by Wayland W. Lessing.

Seventh International Cancer Congress

The Seventh International Cancer Congress will be held in London, England, July 6-12, 1958 under the Presidency of Sir Stanford Cade. Congress headquarters will be The Royal Festival Hall.

There will be two main sessions of the Congress: Experimental, and Clinical Cancer Control. Special emphasis will be placed on Hormones and Cancer, Chemotherapy, Carcinogenesis and Cancer of the Lung.

Proffered papers will only be considered if submitted with an accompanying abstract (not over 200 words) before October 1957 and if dealing with new and unpublished work.

The registration fee for the Congress will be L 10 (ten pounds) or $30 (thirty dollars) and the latest date for registration without late fee will be January 1, 1958.

Registration forms and a preliminary program will be available early in 1957 on application to The Secretary General, Seventh International Cancer Congress, 45 Lincoln's Inn Fields, London, W. C. 2, England; J. H. Maisin, President, Union Internationale Contre Le Cancer, Voer des Capucins, 61, Louvain, Belgium, or Harold Dorn, Secretary General, Union Internationale Contre Le Cancer, National Institute of Health, Bethesda, 14, Md.

Films Available

A revised list of films available through the AMA motion picture library has been prepared and copies are available upon request from Motion Pictures and Medical Television of the American Medical Association. This catalog lists eighty-nine medical films suitable for showing to medical societies, hospital staff meetings and other scientific groups. The catalog also includes forty-five health films of in-

Protein content increases with aging until the third or fourth decade and decreases from the sixth decade on. This decrease may explain the decrease in total brain metabolism.

X-ray microradiography reveals a decrease in pentose nucleic acid concentration in old age while there is a concomitant accumulation of yellow pigment.

Pyruvic acid and alpha-ketoglutaric acid show a relatively stable concentration throughout the life span of the rat. Glutamic acid and glutamine are present in lesser concentration in the aging rat.

The significance of these changes is not known at present.

The Combined Effects of Chlorpromazine and Pentobarbital on Cerebral Hemodynamics and Metabolism. Joseph F. Fazekas; Salomon N. Albert, and Ralph W. Alman. Am. J. M. Sc. **231**:655 (June) 1956.

Relatively large doses of pentobarbital combined with moderate amounts of chlorpromazine were administered to seven patients. Before and after this administration electroencephalograms were made plus studies of cerebral hemodynamics and metabolism. After administration of pentobarbital, characteristic electroencephalographic changes occurred. These remained unchanged or even improved following chlorpromazine administration. "There was a slight diminution of cerebral blood flow and cerebral oxygen consumption after pentobarbital; no interference with cerebral hemodynamics and oxidative reactions was demonstrated when chlorpromazine was also given." All the individuals sedated with pentobarbital showed increased sedation following the administration of chlorpromazine. A combination of the two drugs may be the therapy of choice for the management of refractory hyper-excitable states.

Structural Alterations with Aging in the Nervous System. Warren Andrew. J. Chron. Dis. **3**:575 (June) 1956.

The author reviews his findings and those of others concerning structural changes with aging in the nervous system.

The aging brain is described as lighter in weight, with atrophic gyri and thick meninges. Generally speaking nerve cells become smaller, more ragged in outline, and show an accumulation of lipid material and pigment. Satellite cells tend to increase. The nucleus becomes more basophilic while the cytoplasm loses Nissl substance. The nucleolus becomes paler and is eccentrically placed. Mitochondria and Golgi bodies tend to become less distinct in form while neurofibrillae increase. Apparently dendritic processes also become relatively more numerous.

In addition to these general characteristics there are specific changes. For example, the ventral horns tend to accumulate large amounts of pigment while sensory ganglia show a true fatty degeneration. In certain pathologic conditions the Purkinje cells in man may show amitotic division.

The aging nervous system may also show compensatory or defensive change. Certain hypothalamic nuclei are characterized by amitotic nuclear division as well as formation of giant cells and nucleolar division. These changes may prevent death or degeneration of neurons in the supraoptic and paraventricular nuclei.

Effect of Chlorpromazine on Pituitary ACTH Secretion in the Dog. R. H. Egdahl, and J. O. Richards. Am. J. Physiol. **2**:235 (May) 1956.

Numerous studies have been carried out in an attempt to determine the exact pharmacological effect of chlorpromazine. The authors investigated the effect of various doses of this drug on adrenal function in the dog.

Blood samples were obtained directly from the lumbo-adrenal vein by means of a polyethylene cannula. These were then analyzed for 17-hydroxycorticosteroid content. The chlorpromazine was administered intravenously.

Eight of sixteen animals showed a positive adrenal-cortical response to the chlorpromazine with maximum output attained in from six to twelve minutes. Two of the eight animals with negative responses showed an increased activity when the dosage was increased.

In two animals the effect of chlorpromazine on adrenal 17-hydroxycorticosteroid output was studied before and after hypophysectomy. With the pituitary intact, a marked increase in adrenal steroid secretion was noted following the injection of 50 mg. of chlorpromazine. An equal dose after hypophysectomy produced no demonstrable increase in adrenal steroid output. However, a pronounced adrenal-cortical stimulation occurred in response to 40 U. of ACTH injected intravenously.

The "delayed effect" might conceivably favor the theory of hypothalamic stimulation, but does not exclude the direct action of chlorpromazine on the adenohypophysis.

Care of the Bladder in Neurological Disorders. Herbert S. Talbot. J.A.M.A. **161**:944 (July 7) 1956.

In neurological disorders disturbances of micturition are common. With the following simple procedures the nature of a bladder dysfunction can probably be determined; urinalysis and culture, residual urine determination, observation of voiding habits (frequency and amount), observation of the urinary stream, rectal and pelvic examinations, and neurological examination.

A good discussion is given of management of bladder disturbances in patients with cerebrovascular accidents and patients with diseases of the spinal cord.

The Reflex Responses to Inflation or Deflation of the Lungs and Their Importance in the Regulation of Respiration. J. Garcia Ramos. Am. Rev. Tuberc. **73**:519 (Apr.) 1956.

The respiratory responses of rabbits to inflation or deflation of the lung were measured. It was found that there is a definite relationship between stimulus and response. This relationship does not change with anesthesia up to the surgical level or with moderate increase or decrease of oxygen or carbon dioxide tension in the inspired air. "Only with severe reductions in oxygen tension is there a rise in threshold and more marked inhibition to inflation of the lung with large positive pressures; the Hering-Breuer reflex can maintain a level in pulmonary ventilation for indefinite periods of time even if it appears to be a condition of hyperventilation or of asphyxia; the organism adapts itself more easily to changes of the gas tensions in the blood than to the Hering-Breuer reflex." The importance of this reflex may be noted in lung resection, asthma, and emphysema.

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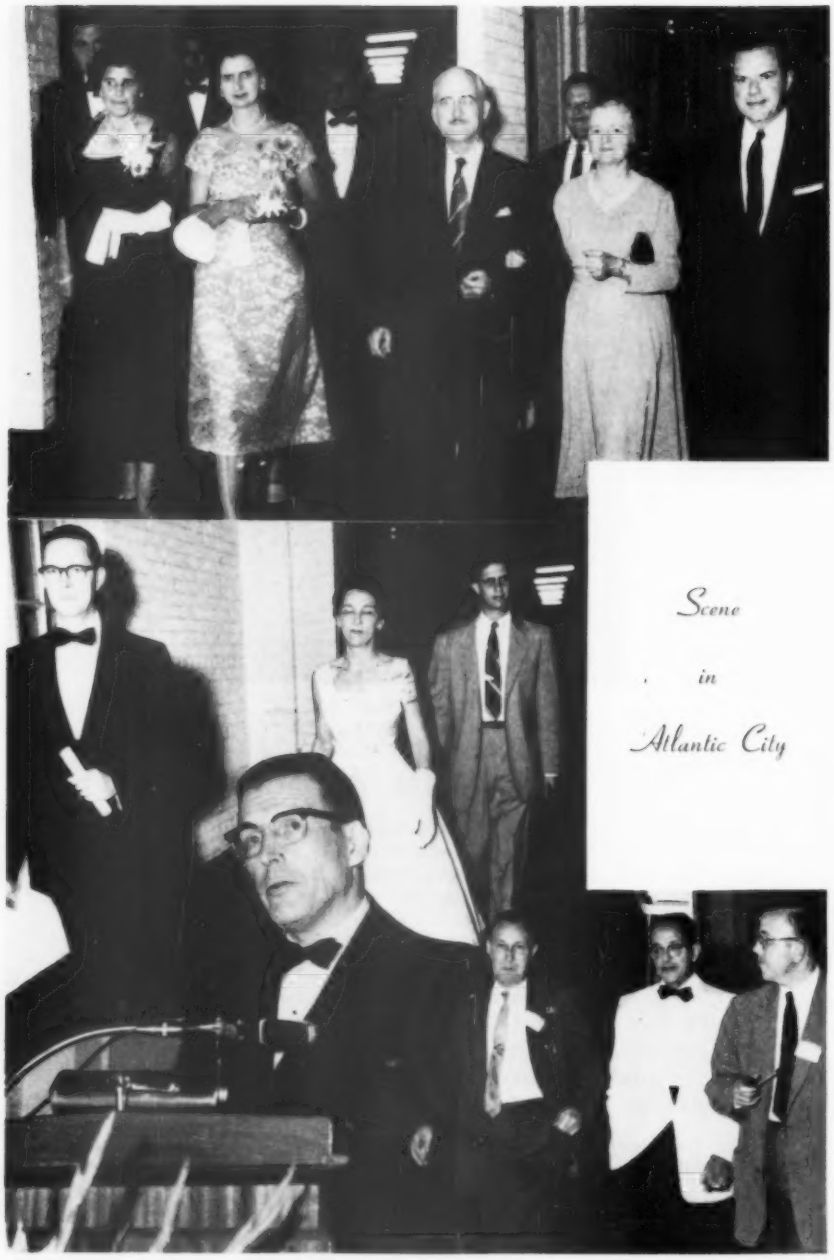

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Personals

At a recent meeting of the Whatcom County Medical Society at Bellingham, Wash., **Albert L. Cooper,** Seattle, spoke on the topic, "The Physical Medicine Approach to Back Pain." — **Michael M. Dacso** of New York City presented the papers "The Teaching of Geriatric Concept in Medical Schools" and "Clinical Aspects of Rehabilitation" before the First Pan American Congress of Gerontology held in Mexico City, September 15th to 22nd. — An orientation lecture entitled "Place of Physical Medicine and Rehabilitation in a Mental Hospital" was given by **Louis Feldman** of Boston at the Boston State Hospital in an attempt to inform resident and intern staffs about the value, indications, and contraindications of physical medicine and rehabilitation in mental disease. — **Maxwell D. Flank,** VA Hospital, Hines, Ill., presented a paper, "Progressive Management of Patients with Spinal Cord Lesions" at the Fifth Annual Paraplegia Conference held October 16-18 at the VA Hospital. — Newest members of the Cleveland Clinic Quarterly Editorial Board are **Otto Glasser** and **Paul A. Nelson.** — **Herbert Kent,** Oklahoma University Medical Center, presented a Diagnostic Evaluation and Patient Demonstration at the Annual Conference of the Oklahoma Chapter National Rehabilitation Association and Governors Committee on Employment of the Handicapped at Oklahoma City on October 2nd. **Shelby G. Gamble,** also of the Medical Center, discussed "The Need for a Comprehensive Rehabilitation Center" at the same conference. **Doctor Kent** also presented a paper entitled "Physical Medicine and Rehabilitation in Medical Practice" at the meeting of the County Medical Society at Alva, Okla., on October 9th. — Chairman and speaker at the medical professional meeting of the Pacific Regional Conference of the United Cerebral Palsy Associations at San Francisco on September 16th was **S. Malvern Dorinson.** — **Igho H. Kornblueh** of Philadelphia was elected chairman of the Section on Air Ionization at the meeting of the International Society of Bioclimatology and Biometeorology held in Paris on August 29th. — **Harry T. Zankel,** formerly of Cleveland, has recently accepted the appointment of Chief, Physical Medicine and Rehabilitation, at the Durham VA Hospital in North Carolina. — The Committee on Awards of the American Medical Association awarded a certificate of merit to **Edward E. Gordon,** Michael Reese Hospital, Chicago, for his scientific exhibit "What Price Ambulation? A Study of the Indications and Contraindications for Paraplegic Ambulation," presented at the 1956 annual meeting. Honorable mention was received by **Ray Piaskoski, Robert W. Boyle, Edwin C. Welsh, Paul A. Dudenhoefer,** and **Albert M. Cohen,** Marquette University School of Medicine, Milwaukee, for their exhibit "Preventive Measures in the Management of the Hemiplegic." — An illustrated lecture on "Physical Medicine and Rehabilitation for the Severely Disabled" was given by **Louis B. Newman,** VA Research Hospital, Chicago, when he addressed the Annual Conference of the Illinois Federation of Women's Clubs on October 25th. — **Ernesto Saldias G.** of Santiago, Chile has been appointed head of a new Section on Physical Medicine at the Hospital L. Calvo Mackenna in the same city. — Under the direction of **Howard A. Rusk** of New York City and his staff, a team of Burmese physicians, nurses, therapists, and psychiatrists will receive a year's training at the Institute of Physical Medicine and Rehabilitation through a grant of $30,000 provided by the Rockefeller Foundation. — **Edwin C. Welsh** of Wauwatosa was elected to a three-year term on the board of directors of the Wisconsin Chapter of the Arthritis and Rheumatism Foundation. — **Ralph E. Worden,** Columbus, will conduct a research project aided by a grant from the Sister Elizabeth Kenny Foundation to the Ohio State University Development Fund, the second of such to aid research in physical therapy at the university. — The following members of the Congress were elected officers of the Section on Physical Medicine at the

1956 Annual Meeting of the American Medical Association held in Chicago this past June: **Louis B. Newman,** Chicago, Chairman; **Miland E. Knapp,** Minneapolis, Vice-Chairman; **Donald A. Covalt,** New York City, representative to the Scientific Exhibit for the ensuing year; **Walter J. Zeiter,** Cleveland, Secretary for the ensuing three years; **Frank H. Krusen,** Rochester, Minnesota, delegate for a two-year term beginning January 1, 1957. **Arthur L. Watkins,** Boston, alternate delegate, was elected in 1955 for a two-year term ending December 31, 1957. — **Constantine G. Psaki** of Philadelphia introduced the use of the electromyogram and its clinical application to the monthly staff conference held on October 18th. Guest speaker was **Francis J. Bonner,** Ardmore, Pa. — Principal speaker at the ground-breaking ceremonies for a new wing at the Elizabeth Kenny Institute in Minneapolis last July was **Frank H. Krusen** of Rochester, Minnesota. — On August 22nd, **Samuel G. Feuer** of Brooklyn co-authored a paper entitled "Limitations of Physical Therapy and Concept of Team-Management of Industrial Low Back," which was presented at the Second International Congress of Physical Medicine at Copenhagen, Denmark. **Doctor Feuer** also spoke before the Kings County Chapter of the National Multiple Sclerosis Society at the Hotel St. George on the subject "Modern Concept and Developments of Multiple Sclerosis." A post-graduate course in physical mdeicine and rehabilitation was instituted by **Doctor Feuer** and his staff on October 4th under the auspices of the Kings County Medical Society and State University of New York, College of Medicine, in the new Rehabilitation Department of the Coney Island Hospital.

Applicants for Congress Membership

Claude W. Garrett, Jr., M.D., VAMTGH, Park Ave. & Getwell Rd., Memphis, Tenn.: Sponsored by Frank J. Schaffer, M.D., Memphis.

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Leon M. Rothman, M.D., 2453 Ocean Ave., Brooklyn: Sponsored by Jerome S. Tobis, M.D., New York City.

Scholarships Available for War Orphans

Under the War Orphans' Scholarship Bill recently signed by President Dwight D. Eisenhower, financial assistance for educational purposes will be available to children of veterans of World War I, World War II, and the Korean War who died as a result of service-connected injury or disease.

This Act will be administered by the Veterans Administration. It permits training in any approved college, public or private vocational school, business school or other approved educational institution. Any school approved for Korean veterans under the G. I. Bill is automatically qualified to accept applicants under the War Orphans' Scholarship program. An estimated 160,000 children of deceased veterans are eligible for benefits under it.

Children with mental or physical handicaps are eligible for special training to help them to overcome their disabilities.

Benefits are $110 a month for full-time training, $80 for three-fourths time, and $50 for half time. Eligible children are entitled to 36 months of education and training, which can begin at completion of high school or at age 18 and extend to age 23. When an individual reaches age 23 in the middle of a term he will be allowed to complete the term. Any eligible person who had not reached his or her twenty-third birthday on the date of enactment of this bill is entitled to full benefits. Those over 18 but under 23 or in military service on the date of enactment are given five years in which to complete their training.

No provision is made in the Act for on-the-job, apprentice, flight training, or correspondence study.

NFIP Appoints New Medical Director

Dr. Thomas M. Rivers of New York City, formerly vice-president of the Rockefeller Institute for Medical Research, has been appointed medical director of the National Foundation for Infantile Paralysis, it was announced by Basil O'Connor, president of the March of Dimes organization.

He succeeds Dr. Hart E. Van Riper, who is leaving the National Foundation on October 31 to become medical director of Geigy Pharmaceuticals of Ardsley, N. Y. Dr. Van Riper joined the National Foundation staff in 1945 and became medical director in 1946.

Mr. O'Connor paid tribute to Dr. Van Riper, saying: "All of us regret his departure exceedingly, after eleven fruitful years with the National Foundation. We were fortunate to have had such a dedicated and gifted physician at the helm of the medical department during the crucial years of vaccine development and improved patient care.

"We also are fortunate that, in these years, Dr. Rivers worked closely with Dr. Van Riper, so that the continuity of our still unfinished fight against polio will not be broken."

Books Received

Books received are acknowledged in this column as full return for the courtesy of the senders. Reviews will be published in future issues of the journal. Books listed are not available for lending.

Electrodiagnosis and Electromyography edited by Sidney Licht; **Muscle Testing — Techniques of Manual Examination** by Lucille Daniels, et al; **Proprioceptive Neuromuscular Facilitation—Patterns and Techniques** by Margaret Knott, and Dorothy E. Voss; **Asclepiades: His Life and Writings** by Robert M. Green; **Biology of the Laboratory Mouse** edited by George D. Snell; **Medical Effects of the Atomic Bomb in Japan** edited by Ashley W. Oughterson, and Shields Warren; **Exorcism and the Art of Healing in Ceylon** by Paul Wirz; **A Scientific Report on the Search for Bridey Murphy** edited by Milton V. Kline; **How to Get Industrial and Business Publicity** by C. E. St. Thomas; **Clinical Psychology. The Study of Persons** by Richard W. Wallen; **Ankylosing Spondylitis** by J. Forestier, et al; **The Neurosurgical Alleviation of Parkinsonism** by Irving S. Cooper; **Doctors' Offices and Clinics: Medical and Dental** by Paul Hayden Kirk, and Eugene D. Sternberg; **Diagnosis and Treatment of Peripheral Vascular Disorders** by David I. Abramson; **Athletic Injuries: Prevention, Diagnosis and Treatment** by Augustus Thorndike; **Directory for Exceptional Children: Schools, Services, Other Facilities** edited by E. Nelson Hayes; **Observations on Krebiozen in the Management of Cancer** by A. C. Ivy, et al; **Physical Measures in the Treatment of Poliomyelitis** by Robert J. S. Reynolds; **Hormones and the Aging Process** edited by Earl T. Engle, and Gregory Pincus; **Blakiston's New Gould Medical Dictionary** edited by Norman L. Hoerr, and Arthur Osol; **Principles of Human Physiology** by Sir Charles Lovatt Evans; **Conquest of Disability** edited by Sir Ian Fraser; **Fluid Balance Handbook for Practitioners** by William D. Snively, Jr., and Michael J. Sweeney; **Cerebral Palsy. Advances in Understanding and Care** by Viola E. Cardwell; **Concise Anatomy** by Linden F. Edwards; **Five Hundred Over Sixty. A Community Survey of Aging** by Bernard Kutner, et al; **Campbell's Operative Orthopaedics, Volumes I and II** by J. S. Speed, and R. A. Knight; **Postural and Relaxation Training in Physiotherapy and Physical Education** by John H. C. Colson; **Silent Spokesman. An Aid to the Speechless** by Wayland W. Lessing.

Seventh International Cancer Congress

The Seventh International Cancer Congress will be held in London, England, July 6-12, 1958 under the Presidency of Sir Stanford Cade. Congress headquarters will be The Royal Festival Hall.

There will be two main sessions of the Congress: Experimental, and Clinical Cancer Control. Special emphasis will be placed on Hormones and Cancer, Chemotherapy, Carcinogenesis and Cancer of the Lung.

Proffered papers will only be considered if submitted with an accompanying abstract (not over 200 words) before October 1957 and if dealing with new and unpublished work.

The registration fee for the Congress will be L 10 (ten pounds) or $30 (thirty dollars) and the latest date for registration without late fee will be January 1, 1958.

Registration forms and a preliminary program will be available early in 1957 on application to The Secretary General, Seventh International Cancer Congress, 45 Lincoln's Inn Fields, London, W. C. 2, England; J. H. Maisin, President, Union Internationale Contre Le Cancer, Voer des Capucins, 61, Louvain, Belgium, or Harold Dorn, Secretary General, Union Internationale Contre Le Cancer, National Institute of Health, Bethesda, 14, Md.

Films Available

A revised list of films available through the AMA motion picture library has been prepared and copies are available upon request from Motion Pictures and Medical Television of the American Medical Association. This catalog lists eighty-nine medical films suitable for showing to medical societies, hospital staff meetings and other scientific groups. The catalog also includes forty-five health films of in-

terest to physicians who may be called upon to speak before lay audiences such as service organizations, Parent-Teachers' Associations, and others.

1957 Mississippi Valley Medical Society Essay Contest

Any subject of general medical or surgical interest including medical economics and education may be submitted providing the paper is unpublished and is of interest and applicable value to general practitioners of medicine. Contributions are accepted only from physicians who are members of the AMA and who are residents and citizens of the United States. Manuscripts must not exceed 5000 words and be submitted in five complete copies, in manuscript style. The winning essay receives a cash prize of $100, a gold medal, and a certificate, as well as an invitation to address the annual meeting of the Mississippi Valley Medical Society. The Society may also award certificates of merit to physicians whose essays are considered second and third best. Essays must be in the office of the M.V.M.S. Secretary not later than May 1, 1957. Winning essays are published each year in the January Mississippi Valley Medical Journal. Further details may be secured from Harold Swanberg, Secretary MVMS, 209-224 W.C.U. Building, Quincy, Ill.

Program of World Congress Announced

The International Society for the Welfare of Cripples is moving ahead with active preparations for its Seventh World Congress on Rehabilitation, which is to be held in London, England, July 22-26, 1957.

The program of the Congress is being developed around the theme, "Planning for Victory over Disablement." Its subtitle, "The Advance, Integration and Application of Knowledge" is intended to keynote further the acknowledged all-importance of the rehabilitation team. The International Society is working toward making this meeting a broad, comprehensive effort that should engage the attention and personal participation of doctors, nurses, scientists, social workers, therapists, teachers, administrators and other professional groups which are concerned with any of the inter-connected problems of the disabled.

The Congress, which will be held at Church House, Westminster London, under the royal patronage of H. M. Queen Elizabeth, offers an unparalelled opportunity for all countries to learn from each other the latest rehabilitation methods and principles which have evolved since the Society's last Congress at The Hague in 1954. The program will include papers on many aspects of physical rehabilitation, with sectional meetings on special disabilities, discussions on propaganda, fund-raising and coordination of services as well as film showings, visits and social events.

It will again be the occasion for the presentation of three Albert Lasker Awards for outstanding individual or group achievement of international significance in the development of services for the physically handicapped. These awards, which are made by the Albert and Mary Lasker Foundation through the ISWC every third year, consist of a cash prize of $1000 each and a silver statuette of the Winged Victory of Samothrace.

The Congress will also stress recognition of the importance of the film medium in advancing all phases of the work for the world's disabled when an international panel of experts will present the World Rehabilitation Film Awards for the second time.

An exhibition, open to delegates and the general public, will be staged concurrently with the Congress and enable voluntary and commercial organizations to display equipment, technical aids and special activities. Available space is now being reserved by many organizations in the United States and early application is recommended.

Rehabilitation Center Institute

The Conference of Rehabilitation Centers, Inc., announces an Institute on Rehabilitation Center Planning to be held at the Morrison Hotel in Chicago from February 25 through March 1, 1957. The Institute will be open to all persons interested in the establishment, expansion or improvement of comprehensive rehabilitation facilities and is being conducted by the Conference under a training contract with the U. S. Office of Vocational Rehabilitation.

The faculty for the Institute will be composed of top professional center personnel from this country and from Canada. Major addresses will be delivered by outstanding national rehabilitation authorities, and a staff of consultants from related fields will also participate.

A feature of the Institute program will be a series of "problem clinics" for the discussion of those details of organization and service which are of major concern to registrants in their local situations.

Conference officials state that the Institute has been planned in response to increasing demands for information and guidance in the development of comprehensive rehabilitation centers.

Inquiries concerning the Institute should be addressed to the Division of Special Projects, Conference of Rehabilitation Centers, Inc., 5 Franklin Avenue, Saranac Lake, N. Y.

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Announcing . . .

The Annual Prize Lecture

sponsored by the

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

To stimulate interest in the field of physical medicine and rehabilitation, the American Congress of Physical Medicine and Rehabilitation will award annually, a prize for an essay on any subject relating to physical medicine and rehabilitation. The contest, while open to anyone, is primarily directed to medical students, interns, residents, graduate students in the pre-clinical sciences and graduate students in physical medicine and rehabilitation. The Prize Lecture Committee suggests that members of the American Congress and American Academy of Physical Medicine and Rehabilitation bring this announcement to the attention of interested persons. The following rules and regulations apply to the contest:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.

2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than June 1, 1957.

3. Contributions will be accepted from medical students, interns, residents, graduate students in the pre-clinical sciences, and graduate students in physical medicine and rehabilitation.

4. The essay must not have been published previously.

5. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION.

6. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.

7. The winner shall receive a cash award of $200, a gold medal properly engraved, a certificate of award and an invitation to present the contribution at the 35th Annual Session of the American Congress of Physical Medicine and Rehabilitation at Hotel Statler, Los Angeles, September 8-13, 1957.

8. The winners shall be determined by the Prize Lecture Committee composed of four members of the American Congress of Physical Medicine and Rehabilitation.

9. All manuscripts will be returned as soon as possible after the name of the winner is announced.

10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Prize Lecture Committee, no contribution is acceptable. The Congress may also award certificates of merit to contributors whose essays may be considered second and third best submitted. Announcement of the winner will be made at the annual meeting.

Birtcher

WHY ADVERTISE HERE?

FOR MANY years now our company has purchased this cover space and for several years previously, inside pages. It's supposed to be "advertising." But we doubt it. I think it quite unlikely that a single reader of this magazine has been influenced to purchase a device with a Birtcher label on it simply because it was illustrated here, accompanied with the usual wordy description and claims. In printed-page advertising all equipment looks alike anyway.

I do think, however, that we and all other manufacturers of physical medicine equipment should purchase space each month to the point almost of extravagance, simply to support this book, the official voice of physical medicine in America. We intend to continue — but there will be no more pictures of machines — no more claims of this, that, and the other. We are not such ignoramuses as to think our equipment cures anything. We make tools of physical medicine as excellent as we can engineer them and as integrity can build them for the price asked in a highly competitive market, but we recognize it takes your skilled hands directed by your trained intelligence to make this equipment useful.

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A Merry Christmas to All and a Great Year of Progress in Physical Medicine!

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